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UNIVERSITY OF ALBERTA

GENERATION OF ALTERNATIVES IN THE PLANNING PROCESS: THEORETICAL DISCOURSE AND A PRACTICAL TEST

BY

PATRICIA E. BAYNE ©

A thesis submitted to the Faculty of Graduate Studies and Research in partial fulfillment of the requirements for the degree of DOCTOR OF PHILOSOPHY.

DEPARTMENT OF GEOGRAPHY

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FACULTY OF GRADUATE STUDIES AND RESEARCH

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research for acceptance, a thesis entitled **GENERATION OF ALTERNATIVES IN THE PLANNING PROCESS: THEORETICAL DISCOURSE AND A PRACTICAL TEST** submitted by **PATRICIA E. BAYNE** in partial fulfillment of the requirements for the degree of **DOCTOR OF PHILOSOPHY**.

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J. D. Porteous
(External Examiner)

Date: January 24, 1992.

Dedication

For my family

and harried mothers everywhere!

ABSTRACT

The principal aim of the thesis is to contribute to the development of a theory of the generation of alternatives stage of the planning process in order to redress a glaring deficiency in urban planning theory. Three research objectives are advanced:

1. To determine the components of generation activity, their relationship to each other and to the needs and requirements of the urban planning process.
2. To identify practical difficulties inherent in generation activity through a case study of the physical plan generation process for the Mill Woods district in southeastern Edmonton.
3. To interpret the significance for plan generation theory of the practical limitations revealed by the Mill Woods case study.

The primary thrust of thesis analysis centers on an interpretation of their natures in terms of the needs and requirements of a rational urban planning process. A number of compelling reasons are presented for treating design and search as linked overlapping processes, with the degree of overlap contingent on a number of factors that vary according to the nature of the problem and the decision-making context. At the same time, it is recognized that each has its own distinctive role in the larger process of plan and policy generation and its own methods, procedures, skills and abilities. Both, in their separate ways, are problematic as well, although the difficulties inherent are more profound - conceptually, methodologically and practically. This is because design hinges on creativity, an essentially black-box process that is based in large part on powerful internal systems of information processing and synthesis that we cannot directly observe or comprehend. There is no infallibly correct process or sequence of operations that guarantee effective design response. Search,

though simpler than design, is made problematic by the quality of "off-the-shelf" information available and the complex nature of the planning task. More often than not, pre-existing solutions must be customized to suit particular problem-settings. Such customization requires a synthetic ability that goes beyond search, to design.

While the thesis concludes that sound generation activity within a rational planning framework is a tenable aim, it also stresses that tenable is not synonymous with easy. The rationality of decision must be seen in light of the bounds of particular planning situations. Planners must operate from a realistic appraisal of what it is they are able to achieve and adjust their expectations accordingly. Above all else, they will have to approach generation activity with more understanding, more seriousness and more rigor than has characteristically been the case if they are to ensure an adequate understanding of problem and a sufficient range of quality options. The Mill Woods case study underscores these points and highlights political feasibility as a significant constraining force on generation activity. In sum, design and search must be seen as integral partners in an urban planning process anchored on a belief in responsible and informed decision.

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I would like to extend warm thanks to the many individuals who contributed in some way to the success of my research. First, to City of Edmonton staff (past and present) for their participation in the research project. In particular, Dave McCullagh, Phil Ellwood, Stuart Bishop, Alex Kachmar and Mike Welykochy gave freely of their time in interview sessions. Their enthusiastic and candid recall of events and issues pertaining to the Mill Woods development truly enriched my learning experience. In addition, special thanks is due to Jim McLaughlin who searched doggedly through box after box of City of Edmonton files to locate the twenty year old documentary material so critical to my study.

As always, I am grateful for the guidance of my supervisor, Dr. P. J. Smith. His constructive comments, his editorial precision and his commitment to excellence were key ingredients in the overall quality of the final draft. It has been a privilege to be his student. I finally have my thats and whiches straight!

Appreciation of another sort is due to my family, for their emotional support. My husband, Don Bayne, sacrificed hours of his time to type the thesis and spent countless more hours feeding and marshaling the Bayne troops - four boys, three dogs and two cats - so that I could devote time to my "school work". My four sons, Ethan, Jarrod, Logan and Rowan kept their patience and sense of humor (despite Dad's dubious lunches) and never doubted me, even when I doubted myself. My mother, Thelma Doyle, spent many hours playing "noughts and crosses" with small boys while I worked behind closed doors.

Finally, I would like to acknowledge Social Sciences and Humanities Research Council for their financial support.

Yes, Rowie, my thesis is *finally* done!

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CHAPTER 1

INTRODUCTION

1.0 The Importance of Alternatives to Sound Decision Making

The generation of alternatives phase in the urban planning process is vital to sound decisions about desired future forms for the city. Its importance stems from the nature of planning as a decision-making process devoted to the exercise of responsible societal choice in the face of conflicting claims of what that choice should be. In fact, the sole justification for public planning rests on its ability, on behalf of some larger social good, to enhance the quality of human intervention into the otherwise unrestrained interplay of forces that shape urban form (Faludi, 1985; De Leon, 1989). Failure to contribute to sound judgment about urban land use undermines the very essence of urban planning. Moreover, it has grave implications for the quality of life of large numbers of people. Decision error is measured in human terms, and mistakes are recorded as long-lasting features of the urban environment (Jones, 1981; Jacobs and Appleyard, 1987). Every implemented decision is consequential: "One cannot build a freeway to see how it works, and then easily correct it after unsatisfactory performance" (Rittel and Webber, 1984, pp.139-140). From this it follows that the process of forethought leading up to planning decisions - the process that informs responsible choice - is of critical concern for planning theorists and practitioners alike. Since the act of choice implies the existence of alternatives among which policy makers can choose, and because good decisions cannot come from poor alternatives, the deliberate generation of sound options becomes an essential element in a responsible decision-making process:

> Whenever one has to judge, one must have alternatives among which one can choose. A judgment in which one can only say 'yes' or 'no' is no judgment at all. Only if there are alternatives can one get insight into what is truly at stake... A decision without an alternative is a desperate gambler's throw (Harrison, 1987, p.50).

Despite the critical link between good decisions and the quality of options put forward for choice, the requirements of alternatives generation have received little attention over the last three decades in comparison with other elements of the decision-making process. This neglect in both the theoretical literature and in practice has been the target of recent comment and criticism (Alexander, 1982; Bass, 1983; Rowe, 1987; De Leon, 1989). As Ingraham (1987) observes, the task of generating alternatives is seldom given the attention it deserves. Many decision makers spend a good deal of effort evaluating and selecting alternatives, but very little time generating them. Nor have planners been particularly adept at wrestling with the conceptual and methodological difficulties inherent in generation activity. Often, they present decision makers with only a few poorly differentiated options, many of which appear to be borrowed ad hoc from other planning contexts (Boyce, Day and MacDonald, 1969; Alexander, 1979; Potter, 1985; Masser and Williams, 1986). Even more disturbing is the documented tendency for public policy makers to devote the greatest amount of decision-making resources to the development of a single solution, rather than a variety of well-spaced policy options (Mintzberg, Raisinghani and Thoret, 1976; Bass, 1983; Harrison, 1987; Rowe, 1987). To make matters worse, the single policy proposal is invariably adhered to throughout the policy-making process, even when severe problems would seem to indicate that a fresh point of departure is needed (Rowe, 1987; Mann, 1987).

Behavior of this kind does not mesh well with the aim of planning to improve the quality of intervention on the urban scene. No matter how adequate a single solution might be, there might always be a better one that could be exposed by a thorough and deliberate generation exercise.[1] And in the event that the single policy proposal is wrong, no amount of refinement will make it right (De Bono, 1985). What is needed, instead, is the identification of different possibilities for choice. These alternatives also meet the needs of planning as a social and political process where a chosen solution must be seen to emerge from the open consideration of competing possibilities (Faludi, 1985). Since planning decisions affect many people, at the very least they must appear to be explicit and rational (Lynch, 1981). Chadwick (1978) even suggests that planners have a *moral* obligation to ensure that society exercises its prerogative of choice from as wide a selection of alternatives as possible.

Practical shortcomings in the generation of alternatives can be linked, in part, to deficiencies in theoretical discourse. For applied disciplines like planning, where the aim of knowledge is to be able to make decisions and take action, effective theory must serve as a basis for developing the strategies and skills necessary for these practical tasks. In turn, practice provides theory with an arena for testing, confirming, refuting, rebuilding and refining theoretical precepts. It serves as a basis for modifying strategies and skills in light of real-world experience and observation (Goldberg, 1985; Alexander, 1986). The relationship between theory and practice is thus cyclical and complementary. In terms of the generation of alternatives phase of the planning process, then, theory must provide an understanding of the nature of generation activity, an interpretation of how that activity relates to the overall nature of planning, and an awareness of the elements of practice that will shape generation exercises in the real world. It is here that the current deficiency rests.

Many modelers of the rational decision-making process confine their treatment of the generation task to but one line - "state the problem and generate alternatives" - before devoting their main attention to techniques for describing the urban system, evaluation and post-implementation assessment (Nadler, Smith and Frey, 1989; Levy, 1991). Those who have made an effort to specify the requirements of plan generation (McLoughlin, 1969; Krueckeberg and Silvers, 1974; Chapin and Kaiser, 1985) focus almost exclusively on quantitative techniques and technical procedures. For example, McLoughlin's (1969) discussion of plan formulation concentrates entirely on statistical manipulations of key components of the land use system as a basis for deriving alternative urban forms. Chapin and Kaiser (1985) devote two chapters to "land use design", where they detail a series of sequential tasks which seem to imply a straightforward, routine translation of "location and space requirements" into land use alternatives. There is limited consideration of the subjective side of plan generation and no attention to what Alexander (1986) calls the "creative intelligence" necessary for alternative derivation. Yet, technical procedures and quantitative analyses will take the planner only so far in determining alternatives for good urban form (Bracken, 1981; Hodge, 1989).

Strategic choice, one highly regarded concept that is often presented as a method for plan generation, further illustrates the nature of the theoretical deficiency.[2] In one recent and characteristic description of the method, two of its leading practitioners devote a chapter-long discussion to the "Designing Mode" which they define as the "stage where alternatives are identified" (Friend and Hickling, 1987). Yet, nowhere in the entire discussion do they consider where alternatives might come from or how they might be developed. Rather, they focus exclusively on defining characteristics of the alternatives once they emerge (that they be mutually exclusive and form as exhaustive a set as possible) and on laying down procedures for sorting out relationships between various aspects of the problem and the solution set. They give no consideration to the conceptual and methodological issues involved in the generation task.

A similar point can be made about the quantitative modeling techniques which received voluminous treatment in planning literature of the 1960s and 1970s (Lowry, 1964; Garin, 1965; Batty, 1969; Echenique, Crowther and Lindsay, 1969; King, 1969; Caulfield and Rhodes, 1971; Lee, 1973). In many instances, large-scale urban models were advanced as a panacea for a wide range of prediction, forecasting and generation difficulties that arise in normal planning practice. Unfortunately, the headlong rush into systematic and "scientific" methods was not preceded by a thorough assessment of their proper role within generation activity. Such an assessment would have required, of course, a firm understanding of the nature of plan generation, but planning theory has been deficient in providing the basis for this understanding. This failure, Alexander (1986) suggests, has serious implications for our understanding of the decision-making process and grave consequences for real-world policy development. Simon (1981, p.121) calls for urgent attention to the nature of the generation task:

> We need to understand not only how people reason about alternatives but where the alternatives come from in the first place. The theory of the generation of alternatives deserves and requires a treatment just as definitive and thorough as the treatment given to the theory of choice.

There are two justifications, then, for research into the nature of the generation of alternatives. First, alternatives are of vital importance to a well-informed and democratic decision-making process. The range of possibilities must be explicitly spelled out in an attempt to improve the quality of decision. The need to specify a range of alternatives restricts the tendency of individual planners to fall back on their own narrow point of view and limited experience and "plump" for the first solution that comes to mind (Jones, 1981; Yewlett, 1985). Second, given the importance of alternatives to effective decision making, the failure of planning theory to address the nature of alternatives generation provides a powerful impetus for immediate research. Very clearly, to inform planning practice properly, theory must provide the knowledge and guidance necessary to enable planners to understand and successfully complete the generation task. As Alexander (1986, p.49) notes, "the capability of designing alternative solutions ought to be one of the planner's unique skills." The nature of this skill has not met sufficient consideration in the theoretical realm.

1.1 Research Objectives

The principal aim of the thesis is to contribute to the development of a theory of the generation of alternatives stage of the urban planning process. To this end, three primary research objectives are advanced:

1. To determine the nature of design and search as the two components of generation activity, their relationship to each other and to the needs and requirements of the urban planning process. Three sequential tasks are central to this objective:
    i. To isolate the characteristics of urban planning that have potential relevance for generation activity.
    ii. To establish the nature of search and design as elements within generic decision-making activity.
    iii. To determine the conceptual and methodological implications of relating generation activity to an urban planning focus.
2. To identify practical difficulties inherent in the execution of the generation of alternatives phase through a case study of the physical plan generation process for the Mill Woods district in southeastern Edmonton.
3. To interpret the significance for plan generation theory of the practical limitations revealed by the Mill Woods case study. The aim is to determine whether refinements in the theoretical framework might be warranted to respond to these practical limitations.

The intent behind the objectives is to redress, in part, the glaring oversight in current theoretical statements by providing an explicit theoretical framework for generation activity. This framework defines design and search in both procedural and substantive terms and identifies the theoretical and practical difficulties inherent in alternative generation within the urban planning process. The structure of the objectives takes account of the critical connection between theory and practice for applied disciplines, like urban planning, where the ultimate aim of theory must be to serve as a framework to guide practitioners.

Since the generation of alternatives is part of the larger process of responsible decision making about urban form, a pertinent theoretical statement about alternatives must relate specifically to the nature of the overall decision-making task. In large part, this emerges from the essence of planning as a social and political process fraught with complexity and uncertainty. The "ill-structuredness" of planning problems, the orientation to the future, the key role of context, and the importance of scale in defining appropriate strategies for tackling problems place specific demands on the shape of an interpretive framework for thesis research. In addition, the concept of rationality, which has been adopted by most planning theorists as the basic criterion for distinguishing responsible decisions from irresponsible ones, becomes an essential element to guide theoretical development. Very simply, rationality states that a decision should be accepted only if it can be shown to be superior to alternative choices measured against the aims deemed relevant. It has provided a framework for most planning process models for more than thirty years and, as such, provides a basic organizing principle for my research.

There has been some, albeit tentative, exploration of the relationship between rationality and the nature of alternatives generation in the planning literature (Alexander, 1982; Stewart, 1982; Yewlett, 1985). While these few discussions served as a good starting point for my research and aided in setting a framework of study, they have not gone far enough. After acknowledging that generation activity presents some methodological and conceptual difficulties, they stop short of a full exposition of these difficulties as they relate to a rational urban planning process. Nonetheless, they represent a marked advance over the norm in planning literature, which tends to refer rather vaguely to plan generation as a blend of "art and science" without exposing either the nature of the art as the creative intelligence required to derive alternatives or the consequences of the blend (Seeley, 1964; Bracken, 1981). The science, of course, is rationality.

1.1.1 The Theoretical Task

It is unlikely that the relationship between alternative generation and rationality will be clearly understood without a thorough investigation of the nature of generation activity. This investigation is the core of the thesis research. The examination focuses on an analysis of the principles and procedures of alternative generation - how it is and might be conducted (Cross,N., 1986). It is concerned with how the people involved in generating alternatives work and think, the skills and information they require, the establishment of appropriate frameworks for their activity (i.e. processes and the methods and procedures to be used therein), the character of planning problems, the nature of solutions and, because planning is a normative discipline, reflection on the fundamental concepts of a generation theory as it relates to the overall needs of the planning process[3] (Cross, 1986, p.410; Gasparski, 1990). These areas of concern - management of the process, the structure of planning problems, the nature of generation activity in practice, the planner as agent in the process, his knowledge and skill requirements, and critical reflection on an appropriate methodology - provide a basic structure for the examination of alternative generation within this thesis.

As specified above, my first research objective was to establish a theoretical framework for the nature of generation activity within the urban planning process. Since the justification for this research rests in the current deficiency in planning literature, it was necessary to review a substantial body of literature outside the planning field. The material spans many disciplines, including architecture, engineering, business administration, management science, art and design, psychology and policy study. The common thread that links the individual contributions for the purposes of my study is a concern with methodology: the study of principles, practices and procedures of alternative generation in a broad and general sense. The review and synthesis of this literature is the principal research method of the thesis. It provides the basis upon which to interpret the nature of generation activity in terms of the specific requirements of a rational urban planning process.

The primary thrust of thesis analysis centers on the activities of search and design, which are identified as the two principal activities involved in generating alternatives:

1. Search - retrieval of pre-existing solutions.
2. Design - invention, or creation, of novel alternatives and the adaptation of existing solutions to new problems.

They are explored and interpreted separately in the thesis to highlight their very different natures and their potentially different ramifications for the rational planning process.

In terms of design, the study examines the processes, methods, knowledge, information, skills and abilities that might foster the invention of new policy and new urban form and the transformation of existing solutions to new contexts (Cross, N., 1986; Rowe, 1987; Schon, 1987,1988; Porter, 1988). As Willem (1988) notes, the essential problem facing design methodologists is that design has not been uncovered sufficiently to know fully what it is. In fact, it may be inherently impossible ever to understand fully what designers "do" and "know" on a cognitive level and how these relate to the invention of novel policy alternatives (Tovey, 1984; Cross, A., 1986; Goldschmidt, 1988; Ward, 1989; Muller, 1989). Nonetheless, there is a voluminous literature which attempts to unravel the elusive character of design: to make plain what can be understood, what can be taught, and what remains beyond the grasp of the designer's comprehension and control.

The overarching theme in this study is the question of process - how designers do and should practice design. Critical to the discussion is a concern with the relationship between problem and solution: how the designer translates a problem into possibilities for choice and what abilities, skills and information enable him to do so, how his experience bears on this ability, and whether or not there is a set step-wise process he can follow in completing the task. Two contrasting design models, the analysis-synthesis-evaluation model and the conjecture-analysis model, are central to the examination, since the vigorous debate surrounding them in the design literature, and advances in design philosophy arising therefrom, bring into relief many key issues involved in interpreting design within an urban planning framework. The former model prescribes a systematic and rigorous exploration of problem and context prior to the formulation of alternatives and choice, while the latter proposes that a single design be conceived in embryonic totality at the outset of the design exercise. The study uses the two models as a skeleton around which to build an analysis of the key methodological areas identified above.

It should be underscored, at this point, that important elements in the investigation of design were not clear in advance. Rather, their identification and subsequent interpretation in terms of planning process theory were principal outcomes of the study. This does not mean, however, that the theoretical framework established here is tentative or uncertain. It rests upon rigorous research in the design field - extensive empirical and descriptive accounts and exhaustive philosophical and prescriptive discourse. It centers on a literature that displays a profound capacity for critical self-reflection and adaptive response. The balancing of experiential practice-based information with rigorous reflection is what ultimately permits the prescription of realistic ideals.

With respect to search, the thesis examination focuses on the nature and quality of pre-existing solutions, the constraints on search activity, the relevance of existing prototypes to new contexts, and the relative role of search within the generation phase. The study further considers whether or not search activity offers a better fit with rational planning requirements than design and if it is likely to produce a well-spaced range of acceptable options for decision makers to choose from. The urban planning literature contains a number of sources that have considered the issue of transferring an existing planning solution to new problems and contexts (Agpar, 1973; Stamp, 1980; Lynch and Hack 1984; Porter, 1985; Masser and Williams, 1986; Goldberg and Mercer, 1986; Cherry, 1986). However, the overwhelming focus in this literature is on identifying and assessing the quality of the final solution and areas of ill-fittedness between the original and recipient contexts for the solution. In contrast, my research addresses the process of search as a part of generation activity and its implications for the rationality of decision making. Combined with the examination of design, the study of search results in the identification of methodological and conceptual difficulties inherent in the nature of generation activity.

1.1.2 The Practical Task: A Case Study of Mill Woods

The second research objective was undertaken to identify practical difficulties involved in the execution of the generation of alternatives phase through a case study of the planning process for the Mill Woods residential district in southeastern Edmonton. It unites the theoretical realm with the practical one.

Mill Woods occupies a site of 2,600 hectares. It resulted from a joint provincial-municipal effort, in 1969-70, to assemble a massive public land bank which was intended to reduce housing prices all over the city of Edmonton by introducing a large amount of cheap land onto the market (Edmonton, 1989). Mill Woods was a direct attempt to halt the spiraling land costs which were identified as the main contributing factor of escalating housing costs, and so to provide affordable housing for some 120,000 people.[4] The Government of Alberta was responsible for land acquisition while the City of Edmonton assumed responsibility for producing a physical plan for the area. The City also maintained responsibility for servicing and developing the land.

With respect to the physical plan, on April 16, 1970, Edmonton City Council overturned a recommendation by its own planning department to award a contract for the plan to outside consultants. Instead it directed the planning department to undertake and complete the task itself. A five-member "Mill Woods Project Team" was struck from planning department personnel and given the responsibility of creating an urban environment of the highest order. On April 27, 1971, just twelve months later, the project team presented the *Mill Woods Development Concept Report* to City

Council. This enunciated social, physical and economic objectives for Mill Woods and prescribed a concrete physical form based upon the stated goals and objectives. The twelve-month period leading up to the concept report is the focus of this thesis research.

The Mill Woods project is an appropriate case study for a number of reasons. First, as a public land bank under sole civic ownership, Mill Woods represents what planning theory deems the ultimate opportunity for planners to exercise control over the planning process and the substance of plan design (Stanland, 1972; Burby and Weiss, 1976; Gallion and Eisner, 1980). Civic officials recognized this when they touted Mill Woods as providing them with an opportunity to employ "the most advanced planning techniques in designing a comprehensive development plan" and giving them the potential to create "a showpiece of new urban growth" (Edmonton, 1971, unpaged). To this end, planners adopted what would appear to be a typical, systematic and rational planning process, including the preparation of alternatives and their testing against "all constraints and planning parameters" (Edmonton, 1971, back cover). The Mill Woods case study therefore allows a consciously systematic planning process to be explored through its actual unfolding.

Second, despite bold claims to quality by civic officials and the appearance of giving conscious attention to the generation of alternatives, the Mill Woods project has been widely criticized for both its social objectives and its complex physical layout. A brief perusal of articles in Edmonton's major newspapers over the last 20 years bears this out. In 1971, less than 24 hours after

City Council approved the outline plan for Mill Woods "by a narrow vote", then-Alderman Leger called for a probe of the project and described it as a "sociologist's dream that could become a nightmare" (Edmonton Journal, 9 June 1971). Since then, newspaper articles have reported claims that the "roads are awful" and service provision "abysmal", and that Mill Woods is growing up amidst "an annoying nest of urban problems" (Edmonton Journal, 21 April 1973; 17 May 1974; 3 March 1978; 4 October 1984; 26 April 1985). In 1974, civic officials firmly denied charges of poor planning in Mill Woods. Yet, eleven years later, they were forced to spend $225,000 on an advertising campaign aimed at dispelling the area's negative image (Edmonton Journal, 17 May 1974; 26 April 1985). A 1989 editorial quoted a University of Alberta professor, James Butler, as saying that the University takes classes of students out to Mill Woods "to show them what not to do"(Edmonton Sun, 17 August 1989). Given this plethora of negative criticism, despite the seemingly textbook application of professional attention, Mill Woods provides an excellent opportunity to examine adversity and difficulty in the real-world evolution of a process: Did something go awry or did the controversial design emerge from a "good process"?

Finally, it would appear, on the surface, that the planners for Mill Woods relied on both search and design to arrive at the final form for the area. In terms of search, the concept report notes that many successful elements from existing new towns were evaluated and incorporated into the plan for Mill Woods. It also speaks of adapting these elements to suit the Edmonton context, which at least hints at design. In addition, then-Alderman Evans, speaking at a symposium on Mill Woods in 1971, described the origin of the Mill Woods plan as "a dream in a planner's brain", implying some measure of innovation and creativity (Edmonton Journal, 2 June 1971). This all suggested that the Mill Woods project should be a good vehicle for exploring the varied aspects of search and design.

The case study relies on three sources of information, each for distinctly different purposes. First, residential planning literature is used to identify prototypical residential designs and trends in thought regarding new community form that would have been available to planners conducting a systematic search of that literature at the time Mill Woods was being planned. This information provides a framework for discussing both the degree and the type of search undertaken by the Mill Woods project team, and the origin of the elements contained in the final concept report. Second, planning documents and records, correspondence, memoranda, minutes of meetings and tape recordings of a three-day "think tank" session for the social/physical design process are used to determine the following: the overall mandate for the process, its trajectory, the organizational context, key issues, key participants, the number and substance of alternatives developed and their sources, criteria used to evaluate the alternatives, opportunities and constraints that shaped the course or outcome of the process, and the nature of that shaping influence.

The third source of information, interviews with five of the individuals intimately involved in developing the *Mill Woods Concept Report*, is used to the following ends:[5]

1. To fill in gaps and clarify points in documentary source material.
2. To trace the actual as opposed to the intended form of the design process. Documentary sources (i.e. formal reports and terms of reference) often describe the intended or normative evolution of a process, while participant accounts allow the actual trajectory of events to be explored.
3. To reveal perceptions of key actors with regard to the course of events.

When combined with the documentary files, the interviews provide a solid base of information for interpreting the practical context for the Mill Woods planning process.

The interview procedure employed a semi-structured or focused format. This permits participants to speak at length, in their own words, on specified themes or open-ended questions of relevance. The technique is particularly appropriate in studies such as this one where the complete population of interest is small, sampling is not indicated and a breadth of information is required (Dixon and Leach, 1978). The merits of semi-structured interviews have been described by Stewart and Cash (1974, p.48):

> They let the respondent do the talking while the interviewer plays his role of listener and observer... Open questions may reveal what the respondent thinks is important, and he may volunteer information you might not think to ask for. They may also reveal a respondent's lack of information or misunderstanding of words or concepts... The respondent might show an uncertainty of feeling or his intensity of feelings toward an issue.

A semi-structured interview format allows a spontaneity of response and the substantial detail that are necessary to a study such as this one, while still permitting the interviewer some control over subject matter. The main drawback is the difficulty of recording, organizing and tabulating the results obtained from the interviews (Stewart and Cash, 1974). To alleviate the first problem, all interview sessions were tape recorded for later transcription to written copy. With respect to the other problems, information was organized into six categories which served as a basic framework for analytic purposes:

1. Evolution of the generation process
2. Nature of the generation activity
3. Characteristics of alternatives
4. The selection of a final concept form
5. Key participants
6. Constraints and opportunities

The rationale behind the categories stems from particular points in planning literature and documentary sources. In terms of the overall approach, as Burton (1981, pp.3-5) expressed it, "what is sacrificed in analytical precision is recompensed through richness and detail".

1.2 Linking Practice and Theory

> Knowledge begins with practice, reaches the theoretical level through practice, and then returns to practice (Mao Tse Tung, 1937, as quoted in Hickling, 1978, p.459).

In this spirit, my study concludes by relating the practical difficulties identified in the Mill Woods case study back to theory. Again, it must be emphasized that the principal focus of the thesis is a theoretical one, and the case study must be seen in these terms. A good case study should contribute to the capability of individuals to solve other problems by enhancing and elaborating the general interpretive framework for a discipline. In order to do so, it must be translated to the theoretical level.

1.3 Outline and Plan of the Study

Chapter 2 presents key characteristics of urban planning, the concept of rationality and the rational planning process. In addition, it identifies the basic structure of the generation stage, clarifies important terminology and presents a rationale for the particular interpretation of generation activity that is adopted in this thesis. In essence, Chapter 2 establishes the bases for interpreting the nature of design and search against an urban planning backdrop. It serves as the necessary first step toward developing a theoretical statement of generation activity for an urban planning focus.

Chapters 3, 4, 5 and 6 address the first objective of the thesis and so form the core of its theoretical contribution. They must be read in concert, because they represent a logical progression from the general, a generic statement of design and search within the decision-making process (Chapters 3, 4 and 5), to the specific, a critical interpretation of their respective natures in terms of the needs and requirements of urban planning. Each chapter serves a different purpose within the progression and each one refines our understanding of the complex and intricate processes that constitute generation activity.

The progression starts with search, in Chapter 3, because in both practical and cognitive terms, it serves as the beginning step in any generation exercise. The chapter identifies the nature of search, examines the form and quality of pre-existing solutions and explores the relevance of existing prototypes to new contexts. Further, it assesses the relative role of search within the overall generation of alternatives phase. In the final analysis, search is presented as an open-ended activity whose form and purpose derives, in part, from the nature of the decision-making task at hand. Search is described as distinct from design, yet integral to the design process. Chapter 4 confronts the nature of design as a creative endeavor. It examines theoretical prescriptions of design process, descriptive accounts of design in practice, creativity and problem-solving theories, and current ideas about design thought and perception. Ultimately, design is portrayed as a complex process embracing many different kinds of thought and knowledge and many different skills and abilities. No recipe-like formula for successful design exists. Chapter 5 discusses the role of design methods and characteristics of the designer as they shape effective design. They are linked, within the chapter, as the tools and strategies that the designer might bring to the design problem - methods - and the personal qualities that affect their use. The chapter clearly concludes that it is the capability of the designer that closes the circle between process or procedure and effective response. Chapter 6 places the information from the preceding three chapters into an urban planning perspective. Design and search are presented as parallel, overlapping spheres which comprise the entirety of generation activity. They are linked by their shared purpose to the decision-making process yet each has its special, unique role to play. And while it is suggested that "good" design and search marry well with the needs of an urban planning framework, it is also suggested that the union requires hard work.

Chapter 7 addresses the second objective of the thesis. It makes use of the Mill Woods case study to explore the real-world constraints on generation activity. The emphasis is on identifying the practical difficulties that might have to be accommodated somehow in generation theory. Finally, Chapter 8 relates the practical difficulties identified in Chapter 7 to the theoretical interpretation established in Chapters 3, 4, 5 and 6. The aim is to highlight those aspects of practice which do not fit the theoretical interpretation, while assessing the implications of the mismatches for suggesting modification of generation theory.

NOTES

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1. This point is contrary to the principle embodied in Simon's (1957) oft-cited concept of satisficing. The concept itself and reasons why it is unacceptable as a guide for the generation of alternatives are examined in Chapter 2.

2. The overall aim of strategic choice is to manage the complexity and uncertainty inherent in planning decisions. To cope with complexity, procedures are spelled out for splitting problems into subproblems of manageable size according to specific criteria which define interconnectedness between decision areas. Uncertainty is managed through a series of decision-making rules which preserve flexibility and discretion for future decision while recognizing the need for immediate action and commitment.

3. This framework represents an expansion of the one presented in Cross (1986) where four methodological areas are identified: management of the process, the nature of problems, realities of practice and philosophy of method. Cross's framework emerged from what he saw as key focuses in the design literature over the past twenty years. The areas of concern I have added to his framework - specifically, the planner as agent in the process, the nature of the solution and the importance of knowledge and skills - correspond with more recent discussion in the design field (Mann, 1987; Porter, 1988; Schon, 1988; Gasparski, 1990; Willem, 1990) and particular points within planning literature (Schon, 1982; Forester, 1982,1985; Kartez, 1990).

4. The failure of the project to secure the aim of reducing land prices on a city-wide basis is the focus of Le Bourgeois, 1981.

5. While not all members of the team have been located (the whereabouts of Frank Grief and J. Schouten are unknown), sufficient representation has been obtained from Mike Welykochy, Stuart Bishop, Dave McCullagh, Phil Ellwood and Alex Kachmar. The specific role of each one in the generation process is detailed in Chapter 7. Participation of all of the team is ensured through the tape recordings of a think-tank session for the socio-physical design, held in July 1970.

CHAPTER 2

CHARACTERISTICS OF AN URBAN PLANNING FRAMEWORK

2.0 Introduction

Given the wealth of information that exists in other fields about the principles and procedures of generation activity, it is tempting to draw directly from this literature without any attempt to interpret or reassess the material in light of the specific needs of an urban planner. Yet, clearly, that would be insufficient. There are particular characteristics that distinguish planning from other professional disciplines. No one would confuse it with what psychologists, social workers, physicians, artists, lawyers or product engineers do, even though the information that will be presented in this thesis suggests that a large number of decision-making methods, procedures and cognitive processes are shared across disciplinary lines. What distinguishes each from the others is the subjective focus of attention and the consequent specifications, standards, limitations and opportunities for professional inquiry and practice within that field. For example, it seems almost intuitively obvious that effective decision making for a medical practitioner, and the ethical considerations surrounding his relationship with each patient, are quite different from how an urban planner must make a decision and his responsibility to the society that is his "patient". Even so-called sister disciplines like urban planning and architecture have significant differences which must be spelled out in order to clarify methodological issues and concerns. It may be acceptable for an architect to present a client with one lone vision of inspired building form that needs no further justification than the architect's own word. Yet an urban planner presenting his interpretation of the single best urban landfill site might find his word subject to much public derision and indignant inquisition. The terms of reference for each discipline, then, are quite different (Pugh, 1982; Schon, 1988). This means that abstract definitions of problem-solving procedures and the nature of generation activity are not enough: "We must also explore what we can say about the service in which these procedures are to be placed" (Rowe, 1987, p.37).

This chapter sets out those characteristics of the urban planning "service" that have implications for generation of alternatives theory:

1. Planning as a social and political process
2. The nature of planning problems
3. The importance of context
4. The varied nature of the planning task
5. Uncertainty and future orientation
6. Rationality and the rational planning process

All have received substantial attention in the planning literature for their impact on either substantive or procedural aspects of plan and policy formulation. Some merit attention because of their practical effects on the nature of generation activity and the skills required. Others - in particular, the social and political nature of planning and rationality as a decision-making criterion - warrant concern from a normative standpoint because they relate to the purpose of planning in society and hence to the role of alternatives within the planning process. Of all of the characteristics, rationality receives the most thorough consideration since it confronts the issue of *how* planning decisions should be made and thereby sets fundamental guidelines for the generation of alternatives stage. The chapter concludes by presenting the basic structure of generation activity within the rational planning process and the terminology that will be used throughout the thesis. Overall, the information that this chapter contains will establish a framework for interpreting the nature of design and search within an urban planning process - for judging where generation activity runs counter to the needs of planning and where planning contravenes the needs of proper design and search.

2.1 Planning as a Social and Political Process

First and foremost, in our democratic system, planning is a social and political process where planners are accountable to the public and its elected representatives for their actions and decisions. At its core, it is concerned with the influence and manipulation of power among competing individuals and interest groups with different values and goals and different conceptions of the best future form for an urban area (Kraushaar, 1988). Democratic ethic posits that each interest and individual in society has the right to expression and representation in the political process. Planners, by virtue of their role as delegated representatives within this process, must ensure that such rights are upheld. Consequently, the range of alternatives they present to decision makers must respond to the diversity of views within the overall client group (Davidoff and Reiner, 1962; Chadwick, 1978; Faludi, 1985). Planners are duty-bound to provide an environment where society's members can exercise choice from as wide a selection as possible (Forester, 1985). In fact, according to Chadwick (1978), widening the range of choice is the best way of describing what urban and regional planning ought to be about.

With regard to the thesis research, this point underscores the need, within the planning process, for the explicit and deliberate generation of a wide range of alternatives. Planners and decision makers alike must be able to justify their recommendations in a process of public debate and scrutiny so that citizens are informed about the range and implications of the various options open to them (Brewer, 1975; Bracken, 1981). A chosen solution must be seen to emerge from a consideration of competing possibilities. The ultimate aim, according to Forester (1985, p.57), is to ensure that alternatives are presented, justifications offered and decisions made in an environment where "only the force of better argument" prevails. This places demands on both the substance of alternatives and their purpose in the decision-making process. A full contingent of well-spaced options must be spelled out and these must be subjected to explicit and deliberate consideration by decision makers in order to ensure the equitable representation of all interests and claims. Alternatives are a democratic necessity.

2.2 The Nature of Planning Problems

A second aspect of planning with repercussions for the nature of the generation task is the form of planning problems.

While problems in the natural sciences are said to be definable, separable and definitively solvable, planning problems are described as "inherently wicked" (Rittel and Webber, 1984) or "ill structured" (Simon, 1973; Mitroff and Emshoff, 1979; Rowe, 1987). They defy efforts at definitive formulation (Cross,N., 1986). Additional questions can always be asked or additional points of view considered which might lead to new understandings and definitions of the problem. Moreover, each statement of the problem represents a particular subjective interpretation. It is quite plausible that different interest groups or urban experts might come up with entirely conflicting formulations of the problem and ranges of acceptable solutions. The tasks of problem finding and problem solving are thus inextricably bound up (Schon, 1980; Rowe, 1987; De Leon, 1989). Wicked problems do not have an exhaustive set of potential solutions, no precise rule terminates the problem-solving process, and there is no immediate and ultimate test of the correctness of potential solutions (Cross, 1986). In addition, every wicked problem must be viewed as essentially unique: "One can never be certain that the particulars of the problem do not override its commonalties with other problems already dealt with" (Rittel and Webber, 1984, p.141). In sum, Bass (1983, p.13-14) suggests that ill-structured problems include one or more of the following characteristics:

1. The problem may be clearly stated but there is no agreement by those dealing with it about an appropriate solution.
2. There is no agreement on a methodology for developing a solution.
3. There may be no agreement on a clear formulation of the problem, objectives, and key variables.

4. Problems are inextricably linked to other problems. Consequently, they cannot be formulated, let alone solved, independently of one another.

These characteristics place important demands on the nature of the overall generation process. The form of inquiry must be capable of mirroring and handling the complexity inherent in wicked problem formulations. In addition, the methods used must acknowledge the subjective judgment and interpretive skills required by practitioners, since planners play a large role in framing the problems they have to solve. In essence, the nature of wicked problems determines that planners should view the relationship between problem and solution as a dialectic one. Each way of stating the problem implies a range of acceptable solutions (Jones, 1983).

2.3 The Importance of Context to the Decision-Making Process

The essential uniqueness of every planning problem stems in large part from the importance of context to the decision-making task. Planning organizations do not operate in splendid isolation. Rather,

> they are part of larger bodies, such as the economic system, the social system, and the political system... Therefore, decision makers must take account of the environment's influences in arriving at a choice, and they must consider the effects of that choice on the many forces that make up the environment (Harrison, 1987, p.144).

Bolan (1969) synthesized the relationship between a planning organization and its environment in his observation that the community decision arena could be considered the "culture" of planning, since its rules, customs and actions shape the nature of planning proposals and set bounds for the type and range of planning intervention. A number of factors, including organizational structure, community power structure, socioeconomic characteristics, legal framework, local political culture, demographic features, the sentiments, values and ideology of participants, the scope, timing and subject matter of proposals, and the personalities, roles and strategies of participants play a role in this regard (Skelcher, 1982; Bass, 1983; Harrison, 1987; Little, 1990). Both the planning process and planning proposals must be appropriate to the framework and routine of the society in which they will be placed. In terms of alternatives this means that it is not possible for any proposal, "no matter how talented and courageous, to step very far outside of its time" (Hiesinger, 1983, p.10; Kraushaar, 1988; Krippendorf, 1989). It must make sense to those who will employ it. A policy exercise, then, must take full account of the intricacies of its setting, as well as the confusion and complexity of political and social environments (De Leon, 1989).

This is no mean feat. The task of moving policy makers beyond the mere assertion of the importance of contextual, problem-oriented inquiry to demonstrate how such concerns can be managed is particularly thorny. An objective definition of context is impossible (De Leon, 1989). The planner cannot step beyond the context he seeks to analyze to provide an omniscient view of all of the key factors relevant to the decision-making process. Instead, he brings with him to each new problem an interpretive framework that sets limits for his present inquiry

(Low, 1982; Schon, 1988; De Leon, 1989; Kartez, 1990). As Jones (1983, p.59) puts it, context is "the hardest thing to perceive, because it includes us, our ways of thinking... Paying attention to changes in conditions and being in readiness to respond to them may not be as easy as it sounds when one is perceiving the world through eyes that have become adapted to seeing only what fits one's aims and objectives". Similarly, it is difficult to establish objective guidelines that separate the truly important elements of context from the trivial - that differentiate between the "signals" of the essential and the "noise" of the irrelevant (De Leon, 1989). Nonetheless, in terms of generation of alternatives theory, both the importance and the complexity of contextual concerns must be acknowledged in the description of the generation task and the prescription of a generation process. Acknowledging how difficult planning is marks the hope for its future (Bolan, 1974).

2.4 Varied Nature of Planning Tasks

Another facet of planning, with implications for generation of alternatives theory, is the varied nature of the tasks that planners are called on to perform. These might range from the preparation of verbal and written policy statements to the translation of these policy statements into spatial form, with varying degrees of physical detail. The type of activity involved in generating options and the range of skills and capabilities required of planners can be expected to change with each of these different tasks. In addition to their presumed skill as land use specialists with firm grounding in land use theory, planners concerned with policy development seem to require a broad base of political and social interaction skills which enable them to negotiate within the conflict-ridden decision-making arena (Kaufman, 1979; Howe, 1980; Alexander, 1986; Kraushaar, 1988). Those involved in the physical form-giving or space-shaping exercises require yet other specialist skills. The term "graphicacy" has been used to summarize the intellectual and practical abilities necessary to these tasks (Balchin, 1972; Yewlett, 1985; Cross,N., 1986). Generation of alternatives theory must provide instruction for each of these very different roles.

In addition, planners must be equipped to deal with problems at different scales of analysis. As Rittel and Webber (1984, p.142) note, every problem can be considered a symptom of another problem when viewed from another perspective:

> Thus 'crime in the streets' can be considered as a symptom of general moral decay, or permissiveness, or deficient opportunity, or wealth, or poverty, or whatever causal explanation you happen to like best.

Isolating the appropriate level at which a solution can or should be attempted is a challenging task. Likewise, the nature of the problem may change as the physical scale shifts from, say, neighborhood to district to city. Solutions deemed favorable for a city budget, overall, may be perceived quite differently in a neighborhood deprived of an elementary school by cost-cutting measures. The important point for generation theory, once again, is that sufficient regard be given to the varied nature of activity that planners must engage in.

2.5 Uncertainty and Orientation to the Future

The above characteristics of planning - its social and political nature, the wickedness of planning problems, the key role of context and the varied nature of planning tasks - point to uncertainty as an unavoidable element in the planning process:

1. Uncertainty in knowledge of the external environment.
2. Uncertainty about policy values.
3. Uncertainty about intentions in related areas of decision (Friend and Hickling, 1987).

Planning seeks to manage systems that are highly interconnected. It is difficult to identify all of the important variables and their interrelationships, let alone reflect this complexity in the data base that describes the planning environment. The definition and weighting of goals and policy values represents yet another challenge. But uncertainty also reflects, more basically, the future orientation of planning:

> We have distinguished the activity of planning as preparing for future actions, thus anticipating future states; it is the choice of those future states of a system which are thought to yield optimum conditions, as described by reference to criteria derived from the goals of the system... Now, of course, the future, in fact cannot be predicted; we cannot know 'the truth' about the future until it has occurred (Chadwick, 1978, p.155).

The operating environment, policy values and organizational interrelationships may change over time. It thus becomes necessary to assess how the planning environment might change and how it might respond to possible future interventions by the decision-making system (Bracken, 1981). It becomes important to estimate the likelihood of each possibility occurring. Forecasting and prediction are thus essential to the plan generation task and yet another consideration for generation of alternatives theory.

2.6 Rationality

The foregoing discussion provides some illumination of the factors that planners must confront in their quest to inform decision-making about future urban form. Yet, it says nothing about the way in which decisions should be made. Questions of proper decision-making practice are the purview of planning process theory and form a critical element in interpreting the appropriate nature of generation activity. Since rationality has been long-advocated by planners as the basic rule for guiding responsible decision making, discussion of the generation of alternatives must center around this criterion.[1]

2.6.1 Rational Planning Models

As noted earlier, rationality has generally been interpreted by planning theorists to mean that a decision should be accepted only if it can be shown to be superior to all other possibilities when measured against the aims deemed relevant for a particular decision-making task. Planning process models based on this concept are structured to preserve the vital link between ends and means by incorporating all of the elements essential to a sound translation of aims into possibilities and these possibilities into choice. They embody a cyclical process involving a series of logically related stages which prescribe how planning should be undertaken (Leach, 1982). Different interpretations specify varying numbers of stages, but most proceed from problem definition and goal formulation through the identification of possible solutions, evaluation, choice and implementation (Figure 1). The progression is from ends to means and from the general to the specific. Each stage is linked to both preceding and succeeding stages such that failure to perform any one step adequately undermines the whole process. In terms of the generation of alternatives, this logical progression is important in two respects. First, alternatives must be goal-driven. They are derived according to the needs and desires identified in the earlier stages of the process. Second, the generation stage is pivotal in linking evaluation and choice to these goals. Without a range of alternatives, it is not possible to determine "best" by demonstrating comparative merits, an essential component of rationality. Alternatives are fundamental to rational choice.

2.6.2 Criticisms of the Rational Model

In its strictest sense, rational planning requires the discovery and evaluation of all possible courses of action and the selection of the one best solution according to predetermined criteria. With regard to the generation of alternatives, criticisms of the rational model have centered, in the main, on these seemingly impossible requirements - the cognitive limitations of the mind to envisage every possible solution; the political, organizational and financial realities that constrain the practical nature of the task; data restrictions; and the general intractability of many planning problems (Simon, 1957; Yewlett, 1985; Harrison, 1987). Central to the discussion is Simon's concept of a bounded rationality:

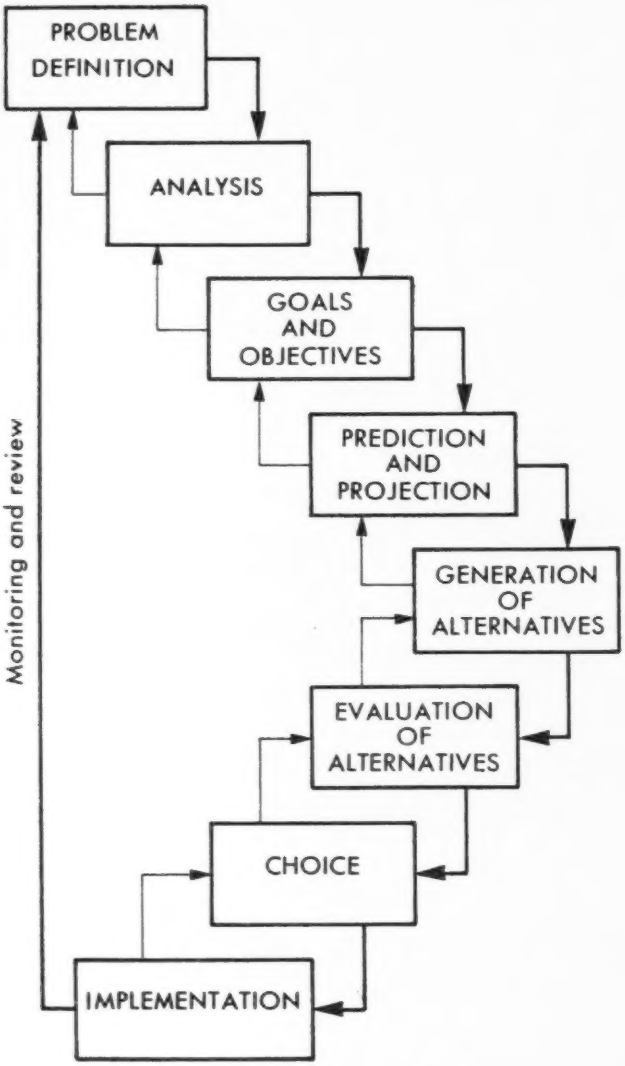
PROBLEM DEFINITION
ANALYSIS
GOALS AND OBJECTIVES
PREDICTION AND PROJECTION
GENERATION OF ALTERNATIVES
EVALUATION OF ALTERNATIVES
CHOICE
IMPLEMENTATION
Monitoring and review

Figure 1: Rational planning process model

> The capacity of the human mind for formulating and solving complex problems is very small compared with the size of the problems where solution is required for objectively rational behavior in the real world - or even for a reasonable appreciation of such objective rationality (Simon, 1957, p.198).

Although, ideally, rational analysis leaves out nothing important, in actual practice it faces many constraints and restrictions. This, according to Simon (1957), means that decision makers should strive to "satisfice" - to discover and select a *satisfactory* alternative - rather than waste time and effort on identifying the ever-elusive optimal one. In this view, alternatives are judged one at a time against minimum standards of acceptability. More recently, however, Yewlett (1985, p.222) cautioned against too much haste in adopting a satisficing approach:

> The idealized 'rational model' has already been rejected as practically and philosophically impossible. The 'satisficing' derivative offers an immediate solution, but also the danger of complacency - selecting the first available alternative may preclude improvements.

In a similar vein, Forester (1985) suggests that planners must reframe the passive voice embodied in the notion of a "bounded rationality" to a more vital concept of the "bounding of rationality" which recognizes that some limits are unnecessary and artificially imposed. In this view, the planners' reading of constraints and subsequent response to them plays a large role in determining the effective bounds of rationality. The planners' behavior in decision-making situations thereby assumes importance.

What is needed is an appreciation of the potential richness within the concept of rationality (Breheny and Hooper, 1985). For some, this means a concern with the ends that a planning process seeks to implement, since the strictly means-ends calculating approach to rational action may lead to morally troubling results (Weber, 1958; Camhis, 1979; Reade, 1985; Darke, 1985). If rationality does not consider the issue of appropriate goals and values, the purposes for which rationality is employed may be irrational:[2]

> It is to lose the whole traditional spirit of the concept of rational behavior to say that a man may 'rationally' murder his friends in cold blood, as long as he structures his choices according to rational action (Churchman, 1962, p.73).

For others, the appreciation of richness and diversity means an emphasis on both the content and the context of decision such that rationality is systematically tied to a consideration of the conditions of communication and exchange that may exist. Here, concern is with promoting equality and opportunity of free choice:

> We must ask: Who acts? In what contexts? In what situations of choice? Constituted by what norms? Limited by what sorts of bounds and constraints..? The crux of the problem of the possibility of rational action... will be the evaluation of threats to conditions of free discourse and unhampered argumentation (Forester, 1985, pp.51 and 57).

Simple ends-means calculations of classical rational models are thereby lifted out of the objective and quasi-technical realm and acquire a social and institutional context of action.

Finally, and with unquestionable pertinence to this thesis research, some suggest that an expanded notion of rationality must admit of the "subjective, experiential and synthetic" knowledge derived through intuition and creativity and necessary to the derivation of alternatives (Weaver, Jessop and Das, 1985; Yewlett, 1985). Moreover, this new "metarationality" must clearly acknowledge that there are things within the synthetic realm that we do not - and perhaps cannot - ever know:

> Ignorance is not peripheral to our knowledge, it is central. Delimiting the bounds of ignorance is every bit as important as delimiting the bounds of our knowledge. Knowing what we do not know, as the ancient Chinese sage Lao Tzu observed, is the beginning of real knowledge: wisdom (Goldberg, 1985, p.127).

The new rationality must go beyond existing rational approaches to recognize a variety of modes of thought. Fundamental to this view is the conviction that planners must reconcile the seeming paradox between the "science" of means-ends rationality and the "art" of creativity (Yewlett, 1985). This paradox is central to the analysis, in this thesis, of the relationship between the generation of alternatives and the rational planning process.

Before turning to a discussion of the relationship between rationality and the nature of the activity required in generating alternatives, it is necessary to make one final point regarding the above criticisms. While they do call into question the narrow interpretations given to the concept of rationality by theorists and practitioners alike, they do not undercut the fundamental notion that choices should be made with strict regard for the aims and goals of the decision-making task. The criticisms are thus insufficient to reject the principle of rationality as a basis for responsible decision making:

> The first and foremost way of criticizing rules of decision making is to show that they do not achieve what they are meant to achieve for reasons of logic. Better still, the way is to show that there are alternative rules which might more usefully be applied to identifying responsible decisions (Faludi, 1985, p.32).

Even Forester's (1985) conception of the rational planner as one who is centrally involved in fostering free discourse and argumentation does not suggest that choices be made without reference to purpose or aims.[3] Rather, like other critics, he wants the conditions that shape rationality - the political, social, organizational and cognitive realities of planning practice - incorporated into our understanding of rational actions and "best" choice:

> The problem of rational planning may then be recognized as socially situated, politically contingent, facing bounds potentially ad hoc or systematic, necessary or unnecessary, in a political world and affecting others who might in principle criticize and accept or reject particular planning actions (Forester, 1985, p.59).

What is needed, overall, is more flexible interpretations of rationality based on practical realities and contextual concerns. In the final analysis, the rationality of a decision is judged in terms of the situational conditions shaping the decision-making process (Faludi, 1985). For the planner, it means that "deciding the bounds of rationality in any given situation and designing the most appropriate form of rationality to fit these constraints are demanding and creative skills" (Leach, 1982, p.15).

2.6.3 The Relationship Between Rationality and the Generation of Alternatives

Even given the call by some planning theorists to expand or modify the concept of rationality, to acknowledge the synthetic, intuitive and subjective knowledge that is necessary for plan generation, there is no uniform agreement as to the best way to accomplish such a union (Goldberg, 1985). In fact, some are concerned that rationality and the activity involved in alternative generation may represent a "head-on collision" of opposing principles (Yewlett, 1985, p.127):

> The use of rationality in planmaking entails a fundamental paradox. Planmaking... entails the deployment of the synthesizing design-oriented attributes of the human mind. But these attributes are associated, physiologically and psychologically, with the intuitive, introspective side of the human brain, in direct contrast to the analytical and rational side. If we accept this, then at first sight rationality and planmaking are essentially incompatible (Yewlett, 1985, p.127).

In these terms, the problem is one of trying to reconcile the "essentially irrational" or intuitive aspects of generation with the concept of rationality. For authors such as Yewlett (1985) and Goldberg (1985), it raises suspicion that a "fully rational" approach to decision making may be both philosophically and practically impossible.

Stewart (1982) sees the relationship between rationality and plan generation in a somewhat different light. While he, too, stresses the intuitive and subjective side to plan generation, he does not see these "irrational elements" as compromising the overall rationality of planmaking. Rather, in Stewart's view, the art of alternative generation and the science of rationality work hand in hand by virtue of their very different roles in the decision-making process. He suggests that rationality does not provide an all-encompassing framework for the entire planning process. Rather, within the process there are three separate domains which he refers to as policy derivation, policy justification and policy adoption. Each requires different rules of behavior and modes of thought relevant to the precise nature of the task at hand.

Rationality is the principal rule in the domain of policy justification where decision makers justify their policies by reference to goals and objectives. The generation of alternatives, on the other hand, falls into the domain of derivation where the principal task is one of developing variety. Rationality conditions the domain of derivation in that its output must pass through an evaluative filter (i.e. means must relate to ends), but it sets no rules to govern where alternatives come from or how they are created:

> In the domain of policy derivation, policy making may involve the imaginative design and the accidental discovery as well as systematic method. The policy analyst needs intuition and accident as much as he needs systematic method. In one real sense, 'anything goes' in breaking out of the constraints of past thinking. But after the accident, the intuition, or the break through, the analyst needs justification (Stewart, 1982, p.26).

The fundamental point is that the rationality of decision is preserved by the relationship of proposed solutions to goals and their subjection, no matter how derived, to rigorous evaluation. The requirement, for Stewart, is not to enlarge the concept of rationality to admit intuitive or creative inputs but rather to enlarge our conceptualization of the decision-making process to recognize the necessity of other decision-making rules. Thus, Stewart provides a framework for interpreting the relationship between rationality and plan generation activity as a complementary and mutually-supportive one.

At the same time, this description does not mean that the nature of plan generation is of no consequence for the rationality of decision. Because the quality of solutions derived at the generation stage plays a critical role in determining the success of subsequent evaluation and choice, there is cause for serious reflection on the relationship between the derivation and justification domains. According to Alexander (1986), this reflection must center on the capability of the planner to produce solutions that are adequate to the needs of rational justification.

In detailing his concern, Alexander suggests that alternatives derive from two basic activities:

1. Creativity - an intrinsically irrational, unpredictable and nontransmutable element which generates new policy form.
2. Search - the 'rational part' which involves the finding and cataloguing of existing solutions.

These activities require very different skills, impose very different difficulties and limitations, and have very different consequences for the overall nature of a generation exercise. Changing the relative blend of the two is said to have very different consequences for maintaining the overall rationality of the decision-making process, the implication being that search offers greater promise in this regard than creativity. Creativity is problematic by virtue of its elusive and unpredictable nature and the consequent limitations it places on the planner's ability to control, understand and learn the alternative generation process. What Alexander is concerned with, then, is a further bounding of rationality based on the planner's inability, at any one time, to conjure up a range of potential solutions if creativity must play a significant role in generation activity. In order to assess whether or not this concern is well-founded and whether or not search does, indeed, hold more promise for rational planning than creativity, it is necessary to carry out a more thorough investigation of the nature of the generation of alternatives stage than Alexander, himself, provides. This examination forms the core of thesis research and is presented in Chapters 3 to 6. First, however, it is necessary to clarify the overall structure of the generation phase and the terminology that will be used throughout the thesis.

2.7 Overall Structure of the Generation Stage

Two types of activity are involved in deriving alternative solutions. The first, *search*, entails the identification of existing prototypes "to be taken off the shelf as occasion requires" (Simon, 1977; Jones, 1981; Willem, 1990). The second, *design*, depends on innovation and creative response, as the following definitions suggest: "To form in the mind by new combinations or applications of ideas and principles" (Gasparski, 1984); "the process of solving problems for which solutions are not already worked out and available in state of the art literature or in an architect's own repertoire of solutions" (Mann, 1987); "behavior which leads to the development of a product characterized by the logical and explicit solution of a given problem and the novelty and originality of its formulation" (Strzalecki, 1990); "bringing new things into being" (Schon, 1987). These definitions make a clear distinction between the relatively routinized activity of search and the invention of new solution forms. The distinction rests on the mechanism of creativity:

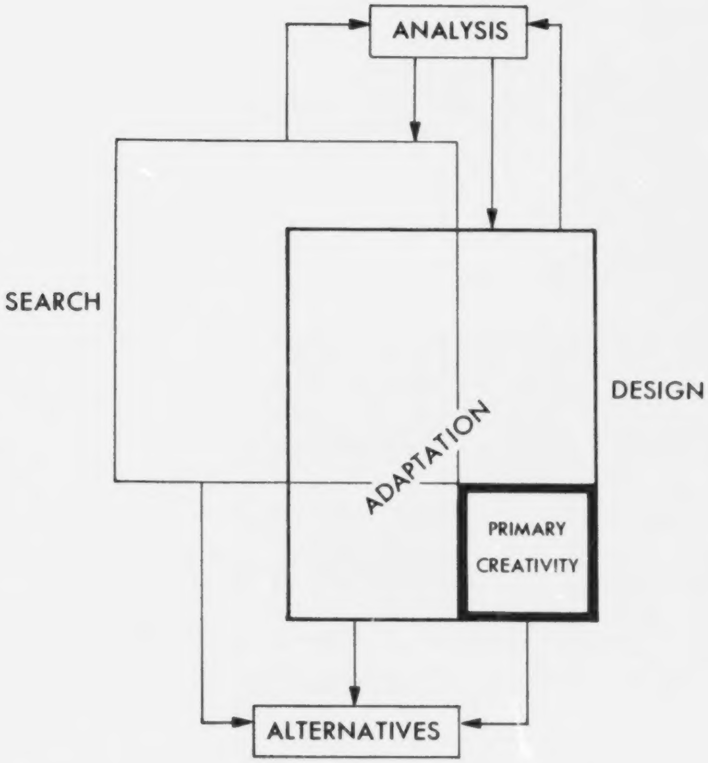
ANALYSIS
SEARCH
DESIGN
ADAPTATION
PRIMARY
CREATIVITY
ALTERNATIVES

Figure 2: Structure of the generation of alternatives phase

> Central to design is the creative act. This is not to imply that all needs are met creatively. Some are met by found solutions in handbooks, catalogues, department stores, etc. However, if a need is met through design, then creativity is involved... Design occurs when the intention to design is present and when the action taken is derived at least in part from a creative sense rather than from instinct or imitation (Willem, 1990, pp.45-46).

At the same time, creativity does not comprise the whole of the design process. Problem finding, problem framing and the intent to develop something new are also important elements in the design task (Schon, 1988; Porter, 1988). And design, in its turn, is only part of the activity planners might engage in at the generation of alternatives phase, where the purpose is "to lay out all possible courses of action", be they innovative or old hat (Brewer, 1975).

In the interests of conceptual clarity, two additional points must be made here about the structure of the generation of alternatives phase; both are illustrated in Figure 2. The first relates to design, and the distinction between *adaptation* and *primary creativity*, a distinction that rests on the degree of "newness" or innovation inherent in the solution form. Whereas primary creativity generates ideas and concepts *de novo*, adaptation develops, expands, modifies and reorders existing solutions (Kirk and Spreckelmeyer, 1988). Kendall (1989, p.92) describes the adaptive process:

> We take forms that we know, and redo them... We propose spaces, bounded by physical elements we imagine, and find the spaces 'like' others we are familiar with, but unlike them in particular ways... We usually begin with a conventional form, begin to tweak it, shift it, make little incremental adjustments of it, then on and on to a final proposal which

> we understand precisely in relation to the conventions in which it lives.

Many see this process of adaptation as the principal means for generating new alternatives within the decision-making process (Lynch and Hack, 1984; De Bono, 1985; Lang, 1987; Porter, 1988; Schon, 1988; Kendall, 1989).

In a similar vein, De Bono (1985) distinguishes between *absolute newness*, as the invention of a concept or form that has not occurred anywhere before, and *new* in the sense of being merely different. He also highlights the dilemma involved in making such a distinction:

> A painter clearly brings into being something that was not there before. Since this painting is unlikely to be exactly the same as a previous painting, there is something 'new'. Yet there may be no new concept or new perception in that painting. The painter may have a strong style and then apply that style to one landscape after another. In a sense there is a production line within a particular style (De Bono, 1985, p.131).

Very clearly, the process of applying concepts that already exist can transcend mere imitation and copying. Otherwise, every application would be identical. Instead, "realizations differ from building to building - and place to place" (Kendall, 1989, p.92). In bringing the old form to the new, the designer is required to apply synthetic knowledge to the task, and it is this synthesis that links primary creativity and adaptation within the broader category of design. Both rely, in some measure, on the mechanism of creativity.

The second point of clarification addresses the relationship between design and search. It reflects, more properly, a conclusion of the thesis research, but is presented here so that the complex concepts detailed in subsequent chapters are easier to follow. As discussion thus far has made clear, there is solid justification for keeping design and search conceptually separate. There are also reasons, forming the core of focus in Chapters 3 and 4, for treating them as linked, overlapping spheres. These relate to the nature of cognitive thought processes, the "wickedness" of planning problems and the structure of the adaptive process which relies on both search and creativity. Understanding the nature of this overlap is critical to developing a proper conceptualization of the generation of alternatives phase.

2.8 Terminology in the Thesis

The only other explanation required here pertains to the specific definition of "design" adopted within the thesis. It is not uncommon in the planning field for theorists to refer to the entire generation stage as the "design" stage, including both search and innovation under the broader umbrella of design (Baum, 1977; Seni, 1978; Alexander, 1982; Lynch and Hack, 1984). In the thesis, however, the term "design" is reserved specifically for generation activity involving creativity. There are two main reasons for this. First, as the definitions cited earlier demonstrate, in the large body of literature that the thesis relies on outside of planning, design is associated with innovative response. Adopting the same terminology here minimizes the danger that ideas and principles will be misapplied in borrowing material across disciplinary lines.

Second, the usage in the thesis recognizes the responsibility planners have to the broader professional community in promoting interdisciplinary study (Ascher, 1987). A proliferation of competing terminologies muddies both communication and the cooperative intent in policy-making processes that require contributions from a diverse group of professionals (Buttle, 1979; Pugh, 1982; Mann, 1987). What can serve to unite different disciplines is a common procedural knowledge (Rowe, 1987). This knowledge must be based on an awareness and appreciation of the reasoning and thought processes that are essential to alternative generation and the commonalties in these processes regardless of whether one is customizing new health care policy, examining alternatives for sewer and drainage systems or detailing the physical form of a new residential neighborhood. In the interest of fostering interdisciplinary understanding and contributing to a knowledge base that transcends the bounds of individual disciplines, planners must adopt common vocabulary.

There is one final point to be made regarding the use of the word "design". Planners have, in the past, tended to view design rather narrowly in the sense of giving physical form to a response to a need or a problem. Hence, urban design is understood to be the arrangement of the physical objects and human activities that comprise the built configuration of the city (Gosling and Maitland, 1984; Lang, 1987). It has already been emphasized, however, that the scope of planning extends beyond these matters to the setting and interpreting of policy directions that guide the concrete space-shaping and form-giving activities. Design, understood in the traditional form-giving sense, does not embody the diverse skills that planners require in meeting these tasks. Nor is it necessary to restrict "design" to such a narrow interpretation. It takes only "one step up the ladder of abstraction" to recognize design as being appropriate to all decision-making processes (Alexander, 1986):

> The effect of designing is to initiate change in man-made things... As soon as we think of this universal definition, we see that it applies not only to the work of engineers, architects and other 'design' professionals but also to the activities of economic planners, legislators, managers, publicists, applied researchers, protesters, politicians and pressure groups who are in the business of getting products, markets, urban areas, public services, opinions, laws and the like to change in form and in content (Jones, 1981, p.5).

This expanded definition suggests that the problem-solving activity that produces physical form and material artifacts is no different fundamentally from the one that produces new urban renewal policy or new foreign defense strategies: "everyone designs who *devises* courses of action aimed at changing existing situations into preferred ones" (Simon, 1988, p.67).

2.9 Relationship to the Thesis Problem

This chapter lays the foundation for describing, interpreting and understanding the generation of alternatives phase in relation to the specific character and requirements of an urban planning process. It ensures that the right questions are raised and the right problems addressed. On the basis of the discussion in this chapter, the following have been identified as specific requirements of a theory to guide alternative generation within a rational urban planning process:

- Processes and methods for generating alternatives must not contravene the basic principle of rationality - that the choice made will be the "best" one and that "best" be measured in relation to the merits of the other options for choice.
- Alternatives must be sufficiently developed to allow proper comparisons among alternatives to be made.
- To enhance both rationality and the planners' social responsibility, processes and methods must support the development of a full range of alternatives.
- Theory must address the democratic/social obligations of planners within a political process.
- There must be sufficient flexibility in process and methods to meet constraints brought about by the context, variety and political nature of planning decisions.
- Theory must provide sufficient guidance to planners about the tasks of both design and search.
- Methods and processes of design and search must be specifically attuned to the "wicked" nature of planning problems.

Given these requirements, the following questions and/or issues of concern are vital to the research:

- Is it possible to maintain the flexibility in approach dictated by the nature of planning without compromising "good" processes of "search" and "design" or the quality of solution?
- Are there areas of tension between rationality and the generation of alternatives in light of descriptions of search and design found in the outside literature? Does one or the other offer a better fit with rationality? Which areas are most problematic?
- Given the analysis of generation activity in the outside literature, is rational planning theory, itself, compatible with the range and type of activity that must be carried out to ensure responsible alternative generation?
- Can the need for public awareness and accountability in planning be integrated with the nature of design and search processes?
- Can planners be expected to have the skill to carry out the tasks of design and search? What skills are required? Who is likely to have these skills? Can the skills be taught or passed on?
- How does the planner determine the nature of the problem to be solved (i.e. how does he make sure he is solving the right problem)? What is the process of

matching problem and solutions?According to Ingraham (1987), policy processes fail more often because they solve the wrong problem than because they get the wrong solution to the right problem.

* To what extent can a more rigorous consideration of the components of the generation of alternatives be realistically incorporated into existing planning processes? Are the methods and processes of design and search, as described in the literature, practicable?

These questions are addressed in the next four chapters. In sum, the framework outlined here forms the basis for an examination of literature from other fields in light of the functional requirements of urban planning. The literature might display generation processes and methods that are out of step with the needs of urban planning - or it may reveal an urban planning process out of step with the needs of "good" generation activity. Such revelation is necessary. Planning process theory can move forward only if the actual nature of the relationship between generation activity and rational planning is established.

NOTES

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1. A debate of the merits of rational planning is beyond the scope of this thesis. Suffice it to say, following Faludi (1985) and Alexander (1986), that the case for rationality becomes stronger when one examines the alternatives to it. It has yet to be superseded. In fact, many of the models presumed to reject the principle of rationality (because they criticize some aspect of the classic rational planning model), such as incrementalism, mixed-scanning and strategic choice, have rationality embedded at their core. Still others, such as transactive planning, which addresses the relationship of planners to their client group (the public), have no obvious point of conflict with the classical rational model other than the manner in which planners have chosen to implement them.

2. Others suggest that the determination of appropriate goals and values rests with elected officials:

> A distinction can still usefully be made between stages which are intrinsically of value choice (and hence, it is assumed, a political responsibility) and stages which are, in principle at least, technical... The insertion of values into the policy-making process and the application of rationality in working through those values are conceptually separate, though interrelated, activities, and these separate identities and the different responsibilities they entail should be explicitly recognized (Leach, 1982, pp.17 and 18).

3. Forester (1985) questions, instead, the nature of the aims and purposes and the resolution of conflict in a political arena where some participants have more power to achieve their aims than others - a loaded game, so to speak.

CHAPTER 3

SEARCH ACTIVITY

3.0 Introduction

Chapter 2 identified search and design as the two principal activities in the generation of alternatives phase of the planning process. Chapters 3, 4, 5 and 6 fulfill the first objective of the thesis by examining their nature, their relationship to each other and their integration into the urban planning mold. Chapter 3 focuses on search activity as the logical first step in the generation process.

At the outset, it is tempting to presume that search, as a matter of laying hands on a past example of ingenuity or creativity, is somehow easier than deriving novelty first hand. But it is necessary to determine if this is actually the case and to establish the implications of applying "old" solutions to "new" problems. In particular, given that the purpose of alternatives to a rational decision-making process is to present a range of well-spaced and appropriate decision options, this chapter examines search activity in light of the need for variety and relevance. It considers the reasons for search, the nature and source of existing solutions, information storage and retrieval processes, the quality of information available, the relationship of solution to context and the costs and benefits of search in pragmatic terms. Search activity clearly plays an important role in the generation of alternatives phase. Paradoxically, however, it is a role at once more circumscribed and yet serving a broader purpose than is evident at first sight. This chapter examines both facets of the paradox, and defines search activity as a sometimes complete and sometimes intermediary stage in the larger process of generating alternatives.

3.1 The Purpose of Search Activity

At the risk of stating the obvious, the reason for taking advantage of existing solutions is to save the practitioner "from having to reinvent the wheel for every problem he/she faces" (Lang, 1987, p.62). Very few problems are unique. Most are similar to those tackled in other settings or in the same setting at a different time. By searching out existing solutions, the practitioner may be able to capitalize on previous applications of problem-solving ability. In the process, he conserves valuable cognitive and organizational resources while gaining access to the wealth of knowledge and experience stored within existing solution forms. His principal aim should be to understand how others have handled similar problems, what factors they identified as important and how the solution form related to the problem being solved. At the fundamental level, such reviews of historical information permit theoretical expansion in the sense of adding to an understanding of what planning is or could be about. They reveal something about the nature of planning and the scope of the planning process (Williams, 1986). In practical and more immediate terms, search through an existing solution inventory might permit the application - or transfer - of solution principles to the present problem setting. This latter role, which ultimately requires a healthy dose of the understanding described in the former, is the principal aim of search within a generation of alternatives exercise.

It becomes necessary, now, to explore the perils and promise in the applications of existing solution forms through three separate focuses:

1. The nature of search activity
2. The objects of search - i.e. the nature of historical information about previous solutions
3. Application of historical information to new problems or contexts

3.2 The Nature of Search Activity

Rational planning, by virtue of its emphasis on the identification of a broad range of alternatives, places clear demands on search activity: it must be motivated, it must be comprehensive, and it must be rigorous in terms of the requirements of the problem. It must be conducted as thoroughly as possible given the particularities of political, social, economic and organizational setting, and the constraints and opportunities inherent therein.

3.2.1 Search in Practice

In view of the cognitive and organizational constraints attached to practical problem solving, it is not surprising that these requirements are seldom met in the real world. In general, search appears to be a rather haphazard and ill-executed affair. Practitioners rely on familiar rather than unfamiliar sources, and tend to draw on the same set of solution forms, principles and standards from problem to problem, regardless of whether they truly fit the current situation or not (Rowe, 1987; Mann, 1987). Moreover, there is a tendency to define the problem in solution terms before it has really been studied (Lawson, 1980). The difficulty, according to Lynch and Hack (1984), is not that prototypical solutions are used in problem solving, but rather that practitioners draw on such a limited set so unrelated to purpose and situation. Instead of seeking out and utilizing the entire arsenal of possibilities available to them, they embrace a narrow set, staunchly refusing to abandon solutions that are blatantly irrelevant (Lynch, 1981; Rowe, 1987; Mann, 1987). Or, simply by relying on a small favored set of prototypes, relevant or not, they impose artificial constraints on potentially more relevant and alternative solution forms (Jones, 1983; Mann, 1987). Even Le Corbusier, widely acclaimed for his architectural contributions in many diverse settings and over four decades, applied certain generic themes and type-solutions which often related more to his personal preference than to the dictates of the problems he faced. Curtis (1986, p.226) speaks of "recurrent schemata" in Le Corbusier's work - "favorite devices that were rarely determined by function". These devices, such as the ramp, pilotis and specific ways of putting together curves, rectangles and grids, became widely associated with Le Corbusian style. Yet, in a very real sense, this style set limits on the range of possibilities available to him in addressing new problem frames[1] (Curtis, 1983). The overall point is that the use of existing solutions should be determined by the nature of the problem and not vice-versa.

In reality, search and analysis are often inadequate, biased by contextual constraints and the values, perceptions, goals and competencies of the practitioners involved (Martin, 1982; Harrison, 1987; Goldschmidt, 1988). Like design, search is a subjective process. The direction it takes and the range of solutions it reveals are a function of the way in which the problem is initially defined (Powell, Evans and Talbot, 1982; Schon, 1988). And, of course, different individuals have different perceptions. According to Harrison (1987), the intensity and breadth of search undertaken is related to the style of the practitioner and the uncertainty and perceived importance of the problem. Often, it stops far short of what is necessary for the best alternatives to emerge. This is because practitioners engage in *premature closure*, ceasing search activity when one or two marginally satisfactory solutions have been identified, but before high levels of solution effectiveness have been achieved (Bass, 1983; Eckersley, 1990). Alexander (1979; 1982) actually documents cases from diverse policy-making situations where practitioners summarily dismissed solutions that would prove, in hindsight, to have been the "best" answers to the problems. They were rejected early in the generation process on the basis of informal and incomplete analysis.

These problems regarding search relate, in part, to situational constraints, the most common being time deadlines which invariably fall short of what would seem desirable from a theoretical standpoint (Bass, 1983; De Leon, 1989). As well, practitioners are often poor time managers, being easily overwhelmed by the amount and content of the information they receive (Harrison, 1987; Mann, 1987; Stinchcombe, 1990). There is a strong tendency to seek out and use irrelevant information (Tversky and Kahneman, 1975; Kartez, 1990).

This last problem is compounded by the fact that much of the information practitioners acquire is untrustworthy, having been distorted, often accidentally but sometimes intentionally, as it is passed on through personal or written channels(Forester, 1982; Stinchcombe, 1990). Lawson (1980) describes one such distortion, the image trap. Here, practitioners eager to "sell" their innovations to would-be critics indulge in "speculative image-making":

> This technique can often be used to disguise the commonplace or familiar and thus mislead us into believing that in some way the design will be free of the disadvantages associated with previous similar solutions... We only have to call a new satellite housing development a 'village' rather than an 'estate' and thus evoke all the pleasant associations already established in our minds with villages (pp.169-170).

Hence, nowhere in promotional descriptions of Columbia, Maryland, the widely touted prototype which was influential on the form of Mill Woods, do we find serious discussion of the difficulties encountered by planners in the year-long planning process. Nor do we find consideration of the economic and social risks involved in the plan's particular mix of socioeconomic groups, or a caution about the limits of any physical plan to guarantee the happiness and well-being promised by the Rouse group. And nowhere is there acknowledgment that many of the plan's principles and arrangements have been recycled from elsewhere (Godschalk, 1967). Rather, the company's reports paint glowing descriptions of "a complete city" which provides a "fullness" of residential, educational, cultural and recreational life "unequaled" in suburban or new town developments elsewhere (Armen, 1976). The clusters of service facilities at the centers of the neighborhood units are the "heart" and "soul" of community life, and pedestrian accessways, the "meandering" country pathways. The larger areas formed by linking neighborhoods together for higher order services are the "villages" and "small towns" of yesteryear, the terminology carefully selected to engender the rich sense of community and belonging sought after by the Rouse company in its self-proclaimed effort to realize "an enormous profit" (Armen, 1976; Rouse, 1978). Thus the image of Columbia was carefully crafted to quicken the interest of potential residents and to raise hopes of utopian living (Godschalk, 1967). Once attracted by images such as these, practitioners lose sight of the way their problems differ from the idealized descriptions; evidence suggests that they underestimate both the degree and the source of information distortion (Harrison, 1987; Kartez, 1990). What they must learn, instead, is to use prototypical information wisely; to be able to assess its deficiencies and to anticipate and recognize possible distortions (Forester, 1982; Bass, 1983; Stinchcombe, 1990). This skill becomes critical to the effective use of information that is garnered from search activity.

3.2.2 Internal and External Memories

In identifying existing alternatives within a generation exercise, practitioners rely on two sources of information which information processing theory distinguishes as the internal and external memories (Figure 3). The internal memory comprises the store of information contained within each practitioner's cogni-

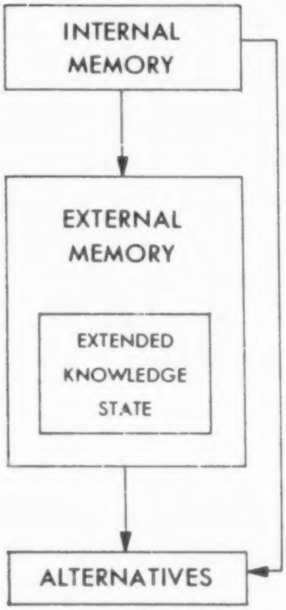
INTERNAL MEMORY
EXTERNAL MEMORY
EXTENDED KNOWLEDGE STATE
ALTERNATIVES

Figure 3: Search process

tive structures by virtue of his particular experience, education and information storage and retrieval capabilities (Martin, 1982; Akin, 1986). It reflects the ongoing cycle of learning and information accumulation that the practitioner engages in as a normal part of professional practice, containing the practitioner's own firsthand experiences, along with cases, prototypes, rules and the like that he has acquired through secondary sources such as personal contacts, professional training, journals, textbooks and code books (Aguilar, 1967; Harrison, 1987). Within a generation process, search through the contents of the internal memory occurs on a cognitive level.

Two additional points must be stressed about the role of the internal memory in search. First, memories differ from individual to individual, even within the same professional field (Martin, 1982; Cross, 1986). This point will be expanded in Chapter 4. Suffice it to say here that individuals have different experiences and they perceive and subsequently store information in very different ways. Thus, although a body of practitioners share common codes and conventions, beliefs and principles, the individual places his own personal perceptual stamp on information passing into his memory structures. The concept of schemas suggests that the values, beliefs and experiences that comprise this perceptual stamp are stored in formal structures within the memory. A schema is defined as follows:

> A generic knowledge structure that guides comprehension, interpretations, inferences, expectations and attention. Schemas are developed as the result of direct experience, training or modeling of other people who make judgments (Graesser and Nakamura, 1982).

They enable the practitioner to process information rapidly and efficiently according to her beliefs and preferences. New information is evaluated for relevance and meaning against the existing schematic structure. This means, according to Kartez (1990), that information is seen as reliable and informative only if it is consistent with existing schema patterns. Individuals tend to hear and see what they expect to hear and see based on previous experience. The implications for search activity are clear. At the very least, neutral and contrary information might be undervalued or ignored; at the worst, it might be misconstrued (Bass, 1983; De Bono, 1985; Kartez, 1990).

Second, with regard to the role of the internal memory in search, different individuals possess differential abilities for storing and retrieving information (Akin, 1986; Rowe, 1987, Eckersley, 1990). Some individuals are able to store larger quantities of information, some are more efficient at organizing what they do store and some are better at remembering the information as it is required. What this means is that the internal memory will be more or less useful in generation exercises depending upon the informational qualities of the individuals involved and the nature of the problem at hand. It may be inadequate - or it may be wholly adequate, if the practitioner's range of experiences, education and past associations, and his storage and retrieval capabilities, are commensurate with those required to expose a full range of existing solution forms.

Evidence suggests that most practitioners begin search in their internal memories. They may move on to additional sources only when *no* viable alternative is found within their cognitive stores (Harrison, 1987). In theoretical terms, they *should* move on to additional sources in the interest of complete search. In this sense, the internal memory serves as a point of departure to more extensive external search investigation.

The external memory is that range of sources outside of the individual's own cognitive structure which extend and augment the capacity of her memory (Akin, 1986). It contains all of the information that potentially could be brought to bear on a problem. The problem solver searches through journals, books, documents, people and the physical environment to find and select relevant information (Newell and Simon, 1972; Akin, 1986). The concept of an extended knowledge state acknowledges that this search is inevitably bounded and that a practitioner's access to the sum of all relevant information is less than complete. As explained by Newell and Simon (1972, p.585), the extended knowledge state contains the information that is "available to the problem solver at a node in the problem space, but not all the information that is in the external memory". Some of the information in the extended knowledge state may duplicate what is already contained within the internal memory. The degree of overlap will depend on the personal characteristics of the practitioner.

The purpose of the external memory to search is simple and easily spelled out: to reveal existing principles, standards, prototypes, cases, policy statements, and so on that are unknown to the practitioner but might be applied directly to the problem at hand. That its purpose is simply put, however, does not mean that the task of search is straightforward and easily executed. Rather, the exploration of memory contents, both internal and external, presents a number of potentially serious problems, some of which relate to the form and content of information and some to the feasibility of applying old information to new situations.

3.3 Form and Content of Information

Even from this brief discussion of information processing, it is clear that both the contents of memory (what is there) and the way it is stored will affect the practitioner's ability, first to retrieve appropriate information and, second, to apply it to his current problem. What this means, in practical terms, is that the information he finds must contain sufficient detail for him to judge its relevance and it must be stored in a form that permits its application in new situations. Thus, it must contain some statement of its original context and its performance there, the problems it was intended to solve, the goals and objectives inherent in its application, and the difficulties and benefits associated with its use (Lynch and Hack, 1984; Booth, 1986; Lang, 1987).

Historical information is generally found in the following forms, each of which will be reviewed in turn:

1. Types and models
2. Principles and standards
3. Formal languages

3.3.1 Types and Models

The first category encompasses solutions in which values, goals, objectives and prescriptions are embedded in a finished form for a part or whole of the solution. This type of information provides concrete descriptions of forms or processes as prototypes or examples to follow (Lynch, 1981). These examples may be theoretical derivations or they may be empirically-based cases. They may be general categories or particular instances of a general form. Similarly, they may be particulars that function in a general way or general categories that have the fullness of particulars (Schon, 1988). The category encompasses:

1. Prototypes and paradigms - patterns or clear and typical examples of certain forms.
2. Generic solutions - concrete combinations of design principles that can be applied as a whole to a group or class of problems.
3. Typologies - classifications of items according to particular instances (Lang, 1987; Rowe, 1982).

They can range from macro to micro scale or from general pattern to detailed archetypal form. They are generally considered trustworthy by virtue of tried and trueness (Rowe, 1987), although there is no clear reason to exclude recent or innovatory forms, by virtue of their status as new types.

Types and models are often employed in urban planning practice. As described above, they might be general, such as the classification of metropolitan form as continuous, nucleated or star-shaped or the transportation system as grid or radial (Krueckeberg and Silvers, 1974; Houghton-Evans, 1980). They might be particular examples of certain forms, such as Vallingby, Sweden, typifying linear expansion, or Columbia, Maryland as an example of the "flower pattern" of new community form (Appendix II). They might also be sets of planning principles, meant to be applied as a whole, such as Clarence Perry's neighborhood unit formula for the organization of the residential environment. Perry's concept is expounded in Chapter 7 of the thesis because of its pervasive influence on residential form throughout the developed world, including Mill Woods.

3.3.2 Principles and Standards

Principles and standards are prescriptive statements which, for urban planning, define appropriate relationships between man and his environment. They provide explicit rules for taking action. Principles are more general than standards, yet they should be specific enough to provide some operational direction. Standards, on the other hand, define precise performance criteria or levels (Chapin and Kaiser, 1985). The following examples, taken from the *Mill Woods Development Concept Report*, serve to make the distinction clear:

Principle:	To focus the community onto an intensively developed central core.
Standard:	Population density must be 20-24 persons per gross acre in the central core.
Principle:	To provide neighborhood services that are easily accessible to small children.
Standard:	Elementary schools must be located within half a mile of all residences in the neighborhood. (City of Edmonton, 1971)

Since neither principles nor standards make overt reference to form models, they are more abstract than the first category, above. As with types and models, however, the practitioner is left to infer the precise nature of the original problem that the solution was intended to solve (Lynch, 1981; Lang, 1987). This means that the rules often appear to be freestanding when, in fact, they are derivative constructs based on some normative conception of appropriate form (Schon, 1987). Types are thus embedded within rules, and a change in judgment as to appropriate type or model necessitates a corresponding switch in principles and standards. The rules, then, are not fundamental truths or laws (Lang, 1987). For example, planners of the 1970s, rethinking suburban land development in view of high land prices and burgeoning energy costs, switched away from the predominantly single-family dormitory suburbs of the 1960s to community models that incorporated substantial amounts of multifamily housing and smaller lot sizes (Burby and Weiss, 1976). Performance expectations and specifications governing lot size and neighborhood densities, and the goals and values underlying them, changed correspondingly. Thus, observes Schon (1988, p.184), when a type shifts because it is mismatched to changing needs or a changing environment, the codified rules collapse and the illusion of independence is lost. Principles and standards must therefore be used with caution (Lang, 1987). Ideally, the practitioner conducting a search will have some familiarity with the type behind the rules. In fact, his ability to judge the use of a principle or standard within his problem setting may well depend on his knowledge of the affiliated type and its appropriate context.

3.3.3 Formal Languages

Information also takes the form of what Rowe (1987) calls formal languages: generalizations of information from the other two categories into connected statements about the good environment. They contain syntactic and semantic ingredients, possessing rules or guiding structures for both the correct functioning and the meaningful ordering of the key elements of urban form. Christopher Alexander's "pattern language" (Alexander, Ishikawa and Silverstein, 1977), an example of this type, illustrates the nature of the information contained within formal language structures.[2] It is worthy of elaboration here by virtue of the considerable debate it has engendered since its publication fourteen years ago.

The elements within Alexander's language are 253 patterns, each one connected to the others and ordered from regions and towns, the largest patterns, through neighborhoods, clusters of buildings, individual buildings, rooms, portions of rooms and details of construction:

> No pattern is an isolated entity. Each pattern can exist in the world, only to the extent that it is supported by other patterns: the larger patterns in which it is embedded, the patterns of the same size that surround it, and the smaller patterns which are embedded in it (Alexander, et al., 1977, p.xiii).

Each pattern describes a problem and the core of a solution that will solve the problem. It also specifies the connections between that particular pattern and others. For example, for the pattern called "identifiable neighborhood", the problem statement is:

> People need an identifiable spatial unit to belong to.

The corresponding solution:

> Help people to define the neighborhoods they live in, not more than 300 yards across, with no more than 400 or 500 inhabitants. In existing cities, encourage local groups to organize themselves to form such neighborhoods. Give the neighborhoods some degree of autonomy as far as taxes and land controls are concerned. Keep major roads outside these neighborhoods.

An explanatory diagram, detailing one possible form that the solution might take, is also given. The accompanying description identifies two related larger patterns, the "mosaic of subcultures" and "community of 7000", and a number of smaller ones: "main gateways", "neighborhood boundary", "parallel roads", "accessible green", "small public square", "house cluster" and "work community". For neighborhood boundary, the solution requires marking the neighborhood "by gateways wherever main paths enter it". Thus, the pattern language specifies key aspects of problem and solution, the relationships between solution elements and an overall structure or organization for each solution form.

Despite the fact that Alexander and his associates referred to their pattern language as only one of many possible languages upon which to structure society, it has been widely criticized for its dogmatic form and presumptions of universal and eternal validity (Protzen, 1978; Lynch and Hack, 1984; Lang, 1987). Its critics maintain that correct form is a question of values, not fact, as Alexander implies, and that such values are rooted in social and cultural context. Dovey (1990, p.7), on the other hand, suggests that Alexander's intent has been misunderstood: "It is clear that the patterns are culturally based, although Alexander is broadly, but wrongly, believed to regard them as universally applicable". If Dovey is correct, Alexander and his associates must share some of the blame for the confusion. For while they encourage readers to solve problems for themselves, in their own way, they emphatically regard a part of their language as representing "the archetypal core" of all possible pattern languages:

> Many of the patterns here are archetypal - so deep, so deeply rooted in the nature of things, that it seems likely that they will be a part of human nature, and human action, as much in five hundred years as they are today (Alexander, et al., 1977, p.xviii).

These patterns are said to be "true invariants". So, for the problem, "no one can be close to others without also having frequent opportunities to be alone", the authors propose the pattern "a room of one's own" as capturing a quintessential facet of human existence. Each family member *must* have a room of her own as far as possible from common rooms. Yet, for many social, economic and cultural settings, this proposition is untenable. It smacks of what Masser and Williams (1986) call academic and technological imperialism: Western solutions are applied unthinkingly to different cultural and social settings such that their ethnocentric assumptions go largely unquestioned. This situation, in which problems and solutions are considered given within a Western frame of reference, extends beyond the pattern language to the application of existing solution forms in general. In fact, the example cited here from Alexander lends much credence to the critics' broader call for a more context-sensitive approach to the definition of spatial form. The issue of the relevance of existing solution forms to new problem settings, and the difficulty of matching solution to context, thus emerge as key factors in defining the role of search within generation activity.

Finally, it is important to know that the three forms of information discussed here will play a role in the design process, as well. This is because of the overlapping nature of search and design, as depicted in Figure 2. In fact, Alexander formulated the pattern language to serve in precisely this sense, as a springboard for the designer's creative response. That he was not particularly successful is suggested by the critical comment *A Pattern Language* has evoked.

3.4 The Application of Existing Solutions to New Contexts

The term *transference* refers to the process of exporting or importing planning ideas from one locale to another. Alternatively, some speak of the *exchange* of planning concepts (Cherry, 1980; Masser and Williams, 1986), but the process is usually more one-sided than that term implies. For settings at similar stages of social, cultural, economic and political development, or those with similar value structures, there may, in fact, be some form of exchange or reciprocal learning experience. The roles of importer and exporter of ideas might shift back and forth from time to time or problem to problem. However, in cases where one of the parties is more advanced than the other, or more powerful in some important sense, the transfer is likely to be one way: always from the stronger to the weaker partner (Stamp, 1980; Masser and Williams, 1986).

Nowhere is the importance of context to the transference issue more vividly demonstrated than in cases involving the application of Western planning solutions to Third World or underdeveloped nations. Solutions are often imposed on the recipient country with little concern for achieving a good fit with the new context. Thus, King (1976; 1977) documents for India and Africa, the deleterious effect of the wholesale transfer of British garden city concepts to indigenous colonial villages having no industrialization and contrasting perceptions of overcrowding, cleanliness, mobility and open space. Indigenous definitions of space and architecture, which were based on traditional values and beliefs and rooted in the practical needs of the native populations, were swept aside in favor of British standards, then in vogue in the homeland. In the interest of physically healthy environments as defined by the exporting colonial power, a new spatial order came into being:

> Rows of minimal 'detached' housing units, surrounded by 'light and air', 'open space', gardens and recreational areas in total disregard of the religious, social, symbolic or political meaning of built environments as expressed in indigenous villages and towns... From a purely physical and spatial viewpoint, environmental standards, norms of building and design derived from the historical experience of the capitalist industrial state and overlaid with its particular cultural preferences were transferred to societies with totally different economic and cultural experience (King, 1980, pp.210,211).

In Nairobi, the new low densities, long intra-urban distances, large lot sizes and inefficient land use patterns have meant high expenditures on physical service infrastructure by the government, as well as long journeys to work for the vast urban poor. The wide, straight streets designed for western automobiles are at odds with the needs of foot-calloused and basically pedestrian Third World workers.

Porter (1985) assesses the application of Western planning solutions to Third World cities in similar terms. Specifically, he targets large-scale slum clearance schemes and urban renewal projects, which he suggests have had profound detrimental effects for native populations. In the examples he cites, from places such as Kowloon, Caracas and Holetown, Barbados, Third World governments have not understood the ramifications of high-rise projects for the social stability of their populations. These cement and steel towers, bearing no resemblance whatsoever to the squatter settlements they have replaced, are at odds with the underlying social and cultural fabric of society. In Caracas, squatter shacks sprang up almost immediately on the open spaces between the newly developed and largely unoccupied high-rises. Similarly, in Brasilia and Rio de Janeiro, the poor sought refuge in *favelas*, cheap informal housing developments with few or no services provided (Cunningham, 1977). Onibokun (1980) discusses, for Nigeria, how the adoption of Western solutions has proved a similarly dangerous course.

In sum, the headlong rush into high technology and Western-inspired solutions has been inappropriate in Third World countries where communities derive stability from their traditional ways of life. The imposition of Western values has disrupted that stability (Goldberg, 1989). The overwhelming lesson from these examples, then, is the need for context-sensitivity in the transfer of planning solutions between dissimilar parties. This sensitivity must extend beyond the simple search for solutions to the stage where the practitioner sets the problem he aims to solve (Schon, 1980). The problem, too, must be defined in culturally, socially and economically appropriate terms. For how one defines the problem will ultimately set real constraints on the direction in which one searches for solutions.

Goldberg and Mercer's (1986) account of the differences between Canadian and American contexts for planning contains a cautionary message against the rash transfer of ideas, even between cultures presumed to be as similar as these two. Canada's urban areas, in general, were found by Goldberg and Mercer to be more compact in form, to rely more on public modes of travel, to be more suburbanized and to have lower status difference between suburban and central households than American cities. In fact, the authors found enough variation within each country's city set to indicate a danger in generalizing even about urban centers belonging to either group. Their message is clear:

> Canada and the United States are distinct and distinguishable places and societies. Moreover, and in keeping with our thrust that cities are tightly integrated into the societies of which they form an important part, Canadian and American cities differ markedly and across well-defined dimensions... Thus, we challenge those students of urban phenomena who in the past were all too prone to oversimplify and over generalize in their quest for powerful, universally applicable propositions about city form, its growth and its inhabitants (Goldberg and Mercer, 1986, pp.246,255).

Robinson's (1986) research into differences between Canadian and American approaches to planning supports Goldberg and Mercer's conclusions. He suggests that three underlying factors contribute to the different forms and approaches in the two countries:

1. Attitudes of residents toward their cities and toward government intervention.
2. The role of local government and other levels of government vis-a-vis urban development, including their respective funding responsibilities.
3. The legal context of and attitudes toward the protection of property rights.

In essence, there are important variations between American and Canadian cities because there are significant differences in socioeconomic, cultural, political, institutional and other circumstances between the two. So, while countries may share similar histories, traditions, values, cultures and political practices on a macro scale - like Canada and the United States - significant variations emerge upon fine-grained analysis (Albers, 1980; Cherry, 1980; Masser, 1986; Ramsay, 1986).

In conclusion, a large part of search activity must center on a systematic evaluation of both the form and the context of existing solutions in relation to needs in the current problem setting. Unfortunately, the requisite information is not easily obtained; there are difficulties in exploring the depths of the context in which particular solutions are rooted. Not only might information located through search be misleading, or untrustworthy, as discussed above in terms of the image trap, it is likely to be incomplete. Published accounts of solution form rarely provide much information about performance and context (Booth, 1986). In addition, simple descriptions of solutions usually conceal the detailed and sometimes intricate assumptions upon which the forms have been based (Lynch and Hack, 1984; Booth, 1986). So, even with an accurate estimation of the current problem, the practitioner may not be able to uncover the circumstances surrounding the success of a solution in the past and may not be able to estimate the prerequisites for its successful transfer in the present. Site difficulties, inter-authority relationships, needs of the user, the nature of the local planning process, financial and political constraints, time deadlines and many more problems remain inscrutable to planning practitioners relying on secondary access to solution form. This does not mean that protypical solutions should not be used, but the practitioner must evaluate information with extreme wariness and a healthy dose of skepticism. He must ensure that his analysis is sound, resisting the temptation to make glib assumptions about either the nature of his own problem or the one that the prototypical solution represents. He must not categorize his own problem in solution terms before it has really been studied. Every problem and every context has its own story to tell. This is the basis on which to begin a generation exercise.

3.5 Adaptation

It is clear, from the above discussion, that the transfer of solutions between contexts is not usually a straightforward process where the importing context can rely on direct and wholesale application of an existing form to its current problem. This means that the role of search in generation activity must be seen in a new light. First though, a point of clarification is required. It should not be inferred that carbon copy, or exact transfer, of solutions is never possible. Its relevance is determined, in part at least, by the level of policy or form abstraction under consideration, particularly between "similar" transfer partners. At very general policy levels it may be reasonable to expect that the intent and usefulness of a solution will be maintained in different locales - sometimes, but not always, depending on context. When general statements must be given concrete substance, however, it is less likely that exact replicas will meet the needs of both places equally well.

In adaptation, the practitioner recognizes that contextual similarities and differences must both be taken into account in generating alternatives. The points of similarity may mean that completely novel solutions are not required. Yet, at the same time, the points of difference suggest that the solution must be modified for it to be applicable. Out of this comes a purpose for search beyond the mere identification of existing solutions for direct application in new problem settings. Search becomes a vehicle for adaptation where conventional solutions are redone so that new forms emerge. These can be understood in relation to the existing form, yet are clearly different in some way.

There are many real-world examples of adaptation, some successful and some not. Ramsay (1986) explains how the British new town concept has taken on distinctive features depending upon the place of implementation. Conscious attempts have been made by importers to adhere to overall new town philosophy, yet modifications have been made in Germany, France, the United States and Scandinavian countries which reflect the specific objectives of the promoters there and the particular circumstances in which the ventures have been launched. The basic new town concept has traveled the world and in doing so generated a wide variety of somehow unique forms. Freestone (1986), for example, discusses how Howard's original garden city concept was adjusted to fit the Australian scene. Here, green belts, which were proposed by

Howard as a means of urban containment and were intended to serve as permanent agricultural reserves around urban centers, became holding grounds for further urban expansion. Similarly, in D'en en Toshi, Japan, the philosophy of the garden city was re-interpreted to suit a social and cultural context that placed greater importance on speculative profit than on the social reforms that Howard held so dear (Watanabe, 1980). In fact, Watanabe suggests that all that was really transferred to D'en en Toshi was the title, "garden city". In another instance, however, Japan provides a striking example of a successful adaptive process. After the Meiji restoration in 1868, leaders carried out a worldwide, 20-year long study of government, business, education, military and arts institutions with the aim of choosing forms most appropriate to their own cultural tradition:

> With this in mind, Japanese leaders trained specialists capable of evaluating the strengths and weaknesses of comparable institutions in each modern country to enable them to select the best models and *make the changes that were necessary to adapt them* to Japanese conditions (Masser, 1986, p.171. - emphasis added).

As a result, in less than 40 years, Japan left behind its feudal, agrarian past to become a modern industrial state.

Two final points must be made here before leaving the related topics of adaptation and transference. First, adaptation might occur before a solution is implemented or it might take place over time as the fit of a particular solution is tested in its new home. Smith (1985) describes this latter process of *cumulative adaptation* for the development of Alberta's early planning legislation in the 1920s. He suggests that the initial borrowing of ideas from American and British sources was done with little modification of the original intent. Yet, by 1929, as experience and knowledge grew in Alberta's government, new legislation revealed ideas and principles that were "distinctly Albertan". Of course, this notion of cumulative adaptation is more relevant to policies and laws, as in this example, than to detailed models of physical form. So, again, the issue of scale or level of generality is important. Once on the ground, it is difficult to re-design highway networks and land-use patterns without incurring prohibitive expense. Unhappily, in this case, it is likely to be the user, rather than the solution, that will adapt over time.

The second point is of critical importance to the overall depiction of the generation of alternatives phase presented in the thesis. It concerns the relationship between search and design (Figure 2). In the process of adapting existing forms to new contexts, the practitioner has crossed the line from pure search activity to design. It is no longer adequate to be able to store and retrieve information efficiently or to conduct exemplary library research. Rather, the practitioner must now be able to see *new* possibilities in the information she has found. The nature of this ability, creativity, is the purview of Chapters 4 and 5. Suffice it to say here that, in the process of adaptation, search is an intermediary step and existing forms a transitory state on the way to contextually-appropriate solutions. The point at which adaptation becomes more design than search is, of course, an arbitrary call. Cases that require substantial adaptation are clearly design, but there is a grey area where minor adjustments and fine-tunings leave the bulk of the original form intact. Here the creative contribution is harder to measure.

This dilemma notwithstanding, the fundamental point remains: search plays two distinct though related roles in generation activity. First, as suggested at the very outset of the chapter, it serves to identify existing solutions for direct application to a current problem. Second, it acts as a forerunner of design - a solid grounding on which to build ideas, concepts and forms that are in some way new. In this second sense, the potential for search lies in its role in adaptive response.

3.6 Conclusions and Importance to the Thesis Problem

On the face of it, search activity would seem to be a simple task. After all, as Simon (1977) implies, what could be easier than locating alternatives already at hand, to be taken off the shelf as occasion requires? But as this chapter indicates simplicity is more apparent than real. First of all, existing solutions rarely exist in neat and complete collections. Rather, the practitioner must identify and seek out a diverse array of source material, some of which might be reliable, some of which might be truly relevant, and some of which might contain sufficient detail for him to assess its relevance. In addition, there is a wide gap between the amount of information that the practitioner might find and the kind he can make use of for decision-making purposes. Often, published accounts lack sufficient detail about performance and context for the practitioner to be able to judge the appropriateness of the solution to the present problem.

The answer to some of these informational difficulties would seem to rest, in part, in improved information storage systems. Some suggest that conscious attention must be given to the development of reference material explicitly for transfer purposes (Lynch, 1981; Gross, Ervin, Anderson and Fleisher, 1988). Alexander's (1977) *A Pattern Language* is certainly a step in the right direction, but its usefulness is marred by complexity and its presumption of universal applicability. Very simply, it is clumsy to use. Above all else, information storage systems must be clear, flexible enough to meet a variety of needs, detailed enough for the practitioner to judge the conditions for a solution's effective performance, and user-friendly. The "visual reference librarian system", developed by Gross, Ervin, Anderson and Fleisher (1988), represents an attempt to meet these requirements for the architectural field. In their computer program, information is stored in the form of images, drawings, diagrams, pictures and verbal descriptions. These are indexed according to form attributes and key relationships evident in the form. Access is obtained by matching constraints faced by the practitioner in his current problem with an existing solution form meeting these terms. The program thus makes an explicit attempt to narrow the practitioner's search to relevant solutions alone. It reflects the understanding that the ultimate aim of search activity must be to facilitate the best possible solutions for a specific, contextually-based problem. The constraints of the problem must dictate the shape of solutions and not the other way around. But clearly, both the quality and the availability of information complicate the role of search in generating such sensitive and effective solution responses.

At least as formidable a problem for effective search relates to the task of actually utilizing solutions once they have been identified. Enough has been said about the importance of context in determining the relevance of existing solutions to new problem settings. What must be reinforced here, though, is the impact that this has on the overall role of search within a rational decision-making exercise. The only way to reconcile existing forms with new problems and contexts is to eradicate the areas of ill-fittedness between the two, by adapting the solution forms. Thus, the value of search in identifying relevant alternatives, certainly a condition of rationality, is in one sense reduced. In another sense, however, by virtue of its role in adaptation, search acquires additional importance. As a result, the identification of existing forms is a task of influence and value, worthy of substantial attention in the generation of alternatives stage.

This chapter fleshes out the nature of search and in doing so, places its role within generation activity into perspective. It begins to define the ways in which design and search are interconnected, although at this point the degree and precise nature of the relationship requires further enlightenment. Chapter 3 has provided information about one side of the generation equation. The next two chapters fill in the other side, for design. Only then will it be possible to show how search and design come together to comprise the generation of alternatives phase of the planning process.

NOTES

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1. The positive side of style as a limiting factor on alternative generation is argued by Rowe (1987). It is given consideration in the thesis in Chapter 4.

2. Lynch's (1981) *Theory of Good City Form*, which details seven dimensions of performance for urban form, is also a formal language. It lacks the performance standards or specifications of Alexander's patterns and provides no physical form to detail the theory, but it is a language nonetheless. It provides a connected statement about good environment with both syntactic (structural) and semantic (meaning) elements.

CHAPTER 4

DESIGN AND THE DESIGN PROCESS

4.0 Introduction

Chapter 2 outlined those aspects of urban planning with direct relevance for the theoretical and practical development of search and design within an urban planning framework. Chapter 3 dispelled the image of search as a straightforward if somewhat tedious exercise (Simon, 1981; Alexander, 1982; Willem, 1990), and revealed, instead, a process made problematic by the quality of "off-the-shelf" information available and the complex nature of the planning task. The ill-fittedness of old solutions to new contexts stood in dramatic relief as the single most complicating aspect for search activity, because the reconciliation of old and new requires a synthetic ability that goes beyond the purview of search, to design. In adaptation, a range of skills and abilities other than those essential to good search comes into play, which allows the planner to introduce an element of change or newness to existing solutions - or, in the case of primary creativity, to derive completely innovative forms. These skills and abilities comprise the creative intelligence central to the design task. And design is fundamental to the effective generation of alternatives within an urban planning process.

This chapter explores the nature of design and the design process in both theoretical and practical terms. What becomes almost immediately apparent is the vast range of information that this investigation entails and its general intractability for succinct and neat description. The difficulties stem, in large part, from the nature of design itself: a complex cognitive process embracing many different kinds of thought and knowledge and many different skills and abilities while remaining, at its very core, elusive to complete description and understanding (Lawson, 1980; Cross, A., 1986; Lang, 1987; Muller, 1989). We are asked to envision the creation of novelty - a break with what already exists - without a clear explanation of where the new idea comes from or a set procedure for guaranteeing that the idea does , in fact, occur (Hiesinger, 1983; Krippendorf, 1989).

Difficulties also arise from the nature of the relationship between design and search. Although the two are treated separately in the thesis for purposes of conceptual clarity, there is no such neat division in actual cognitive thought processes. Rather, the two intertwine so that search plays some role in all creative endeavor. The point where search stops and design begins is difficult to ascertain. This means that some of the information presented in this chapter enlarges on concepts that appear in Chapter 3, but that is needed to relate them to creativity, the one trait that distinguishes design from search. Certain aspects acquire *primary* emphasis here because of the particular problems that arise in relating them to the creative act.

To permit comprehensive investigation of the nature of design and its relationship to search activity, this chapter considers theoretical prescriptions of the design process, descriptive accounts of design in practice, theories about creativity and problem solving, ideas about design thinking and perception, and the interdependence of problem and solution. Nigel Cross (1986) identifies all of these areas of concern as central to achieving insight into the derivation of novel form. It is important to stress at the outset that much of the literature reviewed here is from "design" fields such as engineering, art and design, policy design and analysis and, most particularly, architecture. The areas of ill-fittedness with urban planning that this entails are considered in Chapter 6, where the activities of search and design are reconciled specifically to the needs of an urban planning process.

4.1 Characteristics of Design

> As a human expression, design defies brief description... Words cannot easily hold it; they can easily distort it... Simple, coherent definitions distort by the very fact of being simple and coherent. Design is not to be caught in this way (Baynes, 1976, p.31).

In general terms, design can be understood as the exercise of a particular type of intelligence which enables the designer to translate his interpretation and appreciation of a problem into new possibilities for choice (Schon, 1987; Goldschmidt, 1988; Porter, 1988). It involves rigorous assessment, creative imagination and subjective judgment as the relationship between problem and solution is studied, defined, re-examined, manipulated, redefined, fine-tuned and finally resolved in solution concepts.

Design is thus a complex, multifaceted process involving many different types of thought and activity. And while it is difficult to find (or articulate) a single definition for design which embraces this complexity, it is possible by combining a number of different descriptions to explore its key facets. The following are central to understanding the nature of design activity:

1. Design as a creative process
2. Design as a learning process
3. Design as a subjective process
4. Design as a social process
5. Design as a paradox

4.1.1 Design as a Creative Process

First and foremost, design is a synthetic activity which rests upon creative response:

> Physical design *inventively* mixes together ideas, drawings, information and a good many other ingredients to *create* something where nothing was before (Zeisel, 1981, p.5)
>
> The designer is a blackbox turning inputs into outputs by some *mysterious* process (Lang, 1987, p.38).
>
> Here we are at the creative center. It is a mystery, like all human thought... Design is the imaginative creation of possible form (Lynch and Hack, 1984, p.9).
>
> It is generally accepted that design is a creative occupation and that good designers are themselves creative people (Lawson, 1980, p.106).

The creative element is the primary roadblock to a complete understanding and description of the design process. As Lawson (1980, p. 106) notes, it has spawned years of research and debate, yet "stubbornly remains one of the most unclear, perhaps even confused concepts in the literature of the psychology of thinking". Much of the difficulty occurs because creativity eludes direct observation. It is a cognitive process which occurs largely within the unconscious mind. But saying that creativity and design defy complete understanding does not mean that their practical applications are beyond enhancement:

> Many processes in design occur subconsciously, based on powerful internal systems of logic that we do not

> understand. At the same time, we do understand the overall nature of the decision process so that it is not necessary to regard it as a completely unfathomable process (Lang, 1987, p.37).

Even a partial understanding of creativity, and hence design, permits methodologists to better inform the design task.

Creativity rests at the heart of the transformation of problem information into novel and relevant patterns. It has been examined from a number of perspectives, not all of which are relevant at this point in the thesis.[1] What are of concern, here, are those explanations that attempt to plumb the nature of the creative process. They run the gamut from "rationalist" convictions that creativity can be explained in terms of natural laws or processes to "nonrationalist" beliefs that creativity can never be explained because it completely eludes finite human understanding and ordinary natural principles (Hausman, 1984). The explanations summarized here fall within the rationalist bent.

4.1.1.1 Wallas

More than sixty years ago, Wallas (1926) described the creative process in terms of four stages: preparation, incubation, illumination and verification. With variations in the number and sequencing of stages, his theory remains influential today (Smith, 1974; Arieti, 1976; Crosby and Williams, 1987; Davies and Talbot, 1987; Dacey, 1989). Preparation is the stage where the creative person identifies relevant aspects of the problem. Then, once data have been collected and the problem mulled over, the material is allowed to incubate in the subconscious mind. The ingredients are left to "cook" together until, suddenly, the idea, solution or new relationship is brought to the fore of consciousness. Illumination is thus said to occur when the creative person *sees* a solution. Davies and Talbot (1987) describe this stage in terms of an "imago" in which the designer experiences a momentary glimpse of absolute perfection which must be given concrete physical form. Verification, the final stage, ensures that the new idea is workable (Wallas, 1926; Arieti, 1976; Dacey, 1989).

In this interpretation, the crux of the creative process is the relationship between the first two stages and illumination which is, for all intents and purposes, the creative act.[2] The question is how preparation and incubation bring it about, which Wallas's theory does not even begin to explore. Exposure of the creative process thus remains at a fairly low level.

4.1.1.2 Associationism

The associative school of thought suggests that creative thinking results from the forming of associative elements into new combinations, a rearranging of the consensual patterns and connections of the brain, which allows the designer to see unity and order where chaos previously existed (Mednick, 1962; Rowe, 1987; Dacey, 1989), Creativity is the process by which ideas already in the mind are associated in unusual, original and useful combinations. A number of ideas not previously related to one another are juxtaposed on an unconscious level. The creative flash of insight occurs when the consensual patterns of the brain are rerouted such that a pattern emerges that is consistent with problem inputs. Associationism theorizes a process of unconscious, trial-and-error search for new arrangements or patterns of information out of which novelty can emerge.

4.1.1.3 Gestaltism

Gestaltists believe that creativity is more complex than the mere association of ideas in new ways; the whole of any idea is said to be more than the simple sum of its parts. Within this framework, creative individuals develop an overview of the entire structure of a solution and then work backwards to arrange the parts. Creativity occurs when an existing overarching mental concept, or "Gestalt", is reorganized or restructured.

4.1.1.4 Information Processing Approach

In contrast to the above three approaches, the information processing theory attempts to shed light on the nature of the cognitive processes involved in the formulation of novel solutions. It suggests that creativity - and problem-solving behavior in general - can be explained in terms of a number of primitive thought processes which are organized hierarchically and executed serially. These involve the gathering of information from the environment, its transformation and storage in codes and patterns via short-term and long-term memory functions, and the recall of information when required. In these terms, an information processing system (IPS) consists of the following:

1. Receptors which gather information from the environment.
2. Memory which contains symbol structures for storage and retrieval purposes.
3. Processor which uses short-term memory functions to:
    a) manipulate incoming information into codes internally consistent with symbol structures in the memory,
    b) transform internal symbols and relations to be consistent with incoming input, and

c) convert internal symbols into codes that can be transmitted to the external world.

4. Effectors which manipulate the environment through motor behavior (Akin, 1986, pp.12-13).

In terms of creativity, the processor is the key component of the system. It manipulates and packages incoming information and directs and carries out the system's operation. In essence, it assesses the relationship of information within memory stores to the problem at hand. According to Newell and Simon (1972, p.20), the processor contains three basic elements:

a) a fixed set of elementary information processes that constitute the *elementary information process system* (EIPS).
b) a *short term memory* (STM) that holds input and output of the EIPS.
c) an *interpreter* that determines the sequence of EIPs to be executed by the IPS as a function of the symbol structures in the STM.

Elementary information processes are a general and powerful set of operations which act upon the symbol structures within the memory. They permit search of existing memory contents, comparison and evaluation of symbol structures to see how they differ, their adaptation, and the creation of entirely new ones (Lindsay and Worman, 1972). These elementary processes, which Simon (1977) suggests rely on large amounts of highly selective trial-and-error search, are what enables the designer to reason his way from an initial problem state to some new solution form. They are called into play by the interpreter, which selects and sequences the series of operations to be utilized in exploring memory contents.

In this way, the nature of an individual designer's processing capability plays a significant role in the likelihood of creative response - his abilities in coding and storing information in memory and retrieving it, in appropriate form, when required. Representation refers specifically to an individual's ability to impose effective order on the vast array of information contained in the mind. Effective ordering makes for efficient recall. But efficient recall also depends on the heuristics that the individual utilizes to conduct his search through the maze of information, well-coded or not. The designer's choice of strategy is critical, as an example comparing the behavior of ordinary chess players and grandmasters demonstrates:

> Both classes of players searched for about the same length of time, and examined approximately the same number of branches of the game tree. In fact, it was impossible to distinguish, from the statistics of the search, between the grandmasters and the ordinary players. They were easily distinguished by one datum, however: In the particular position examined, all five grandmasters attained better solutions to the problem than any of the solutions attained by the ordinary players. While the grandmasters did not engage in more search than the others, their superior selective heuristics allowed them to search more significant and relevant parts of the game tree (Simon, 1977, p.291).

Currently, the information-processing theory is the dominant school of thought about creative problem solving within the design field (Akin, 1986; Rowe, 1987). Nonetheless, it leaves key questions about design unanswered. What causes an individual to select particular strategies or heuristics? Surely experience plays a role (Simon, 1977; Schon, 1987; Sebba and Boers, 1987), but even experienced problem-solvers utilize different rules and heuristics in seeking a solution (Schon, 1988; Porter, 1988). What determines how individuals attend problems? What causes different individuals to read and structure problems differently? And what, within the information-processing system - or, more specifically, the processor - enables the repatterning of information in different ways to produce novelty? The idea that information is actively organized and reconstructed within the information-processing system, and that some executive function controls the formatting (i.e. the interpreter), is acknowledged within the theory.[3] But while we have a name for the functions, we still do not know *how* the information is encoded and manipulated and *why* some information is attended and some not. The intricate and subtle workings of these processes appear to defy understanding, although information presented later in this chapter and in Chapter 5 will illustrate key aspects, such as cognitive style, personality, talent and perception, as central to the processing task.

4.1.1.5 The Role of Brain Physiology in Creativity

It may be that the mysticism surrounding design will never be fully exorcised. One plausible reason comes from the field of brain physiology where, after many years of clinical testing, the theory of the bilateral brain remains in high esteem. It is worth describing the theory and the resultant categorization of mental functioning in some detail since it supports current views of design as encompassing different and distinct (if not antagonistic) modes of thought.

Thinking, sensation and perception occur in the cerebral cortex of the brain which, in functional terms, is divided into two hemispheres - the right brain and the left brain. As early as the nineteenth century it was discovered that lesions in the right brain had different effects from those in the left. While right brain tumors and surgery affected spatial orientation and recognition of faces, left brain injury impaired language ability (Hampden-Turner, 1981; Tovey, 1984). Subsequent medical research and treatment has revealed that when the brain is split by cutting the corpus callosum, the band of nerves joining the two halves, it continues to function well, although with some impairment. For all intents and purposes, two independent minds exist within one head (Gazzaniga, 1977; Tovey, 1984; Dacey, 1989). Experimentation has also revealed that each side of the brain is specialized in terms of thought process and function. In general terms, it is accepted that the left side controls language tasks and the right hemisphere visuo-spatial thought. Based on this division, each hemisphere has different information-processing roles:

> Left Hemisphere: verbal; analytic; symbolic; abstract; logical; linear; digital; and time oriented.
>
> Right Hemisphere: non-verbal; synthetic; concrete; analogic; intuitive; holistic; spatial; and timeless and diffuse (Tovey, 1984, p.220).

The right hemisphere controls *appositional* thought which involves parallel processing, holistic patterning, metaphors and analogic codification. The left brain controls the *propositional* thought of the serial, linear relationships in grammar and mathematical logic (Bogen, 1977; Tovey, 1984; Cross, A., 1986). The cable of nerve fibers that connects the two hemispheres transmits the separate processes of each to the other. In this way, their different views of reality are reconciled (Edwards, 1986).

Both halves of the brain contribute in all but the simplest tasks but, depending on the nature of a given task, one will be operating in a dominant role. In terms of the encoding function, described above with respect to information processing, the left hemisphere dominates when information is compatible with existing codes and structures while the right hemisphere is critical in novel situations, where new codes must be assembled (Cross, A., 1986). This means that the right hemisphere dominates in the creative process. And since the right brain is mute and cannot communicate in words, the essence of what goes on in synthetic activity might always elude human comprehension:

> The way designers work may be inexplicable, not for some romantic or mystical reason, but simply because these processes lie outside the bounds of verbal discourse: they are literally indescribable in linguistic terms (Daley, 1984, p.10).

Once new codes have been identified and assembled by the right brain, the left hemisphere assumes dominance in their use (Cross, A., 1986). The point when the two hemispheres come into contact and communicate with one another, and a right-to-left shift of dominance occurs, is said to account for the "eureka", or instant illumination, phenomenon. The solution suddenly becomes accessible for verbal description (Tovey, 1984; Dacey, 1989). In these terms, the subconscious nature of creativity is a function of brain physiology.

4.1.2 Design as a Learning Process

Learning is fundamental to the process of design, although few make the connection as explicitly as the authors of the following extracts:

> Design is a process in which creativity and knowledge (science) interact to produce novelty in the man-made world (Willem, 1990, pp.44 and 47).
>
> The design process is a learning process... This is because a designer is quite clearly learning about the design problem as he attempts to solve it (Cross, 1983, p.37).
>
> I think of [the design process] as a specially designed 'education' or 'course' which one devises, and undertakes in order to complete the design (Jones, 1981, p.xx).

Even when design is described as a process of exploring constraints (Cross, Naughton and Walker, 1981), or a process of framing and reframing the problem (Lynch and Hack, 1984), or as a reflective conversation with the elements of a situation (Schon, 1987), learning is implicit. As noted in Chapter 2, wicked problems do not present themselves to the designer as neat formulations - "the formulation of a wicked problem *is* the problem" (Rittel and Webber, 1984, p.137). Fuzzy objectives, dense interrelationships among various elements of the problem context, and the dialectic relationship between problem and solution mean that the designer begins the design process in a state of ignorance about what is needed to prescribe solutions. Knowledge comes through attempts to solve the problem: collecting information, clarifying constraints, experimenting with framing the problem and exploring the consequences inherent in each frame. Evolving frames reflect new understanding and knowledge. New knowledge, of course, reflects learning.

Schon (1983; 1987; 1988), whose theory of design and design knowledge is presented more extensively later in this chapter, describes the process of learning in terms of a designer's reflective conversation with the materials of a situation. As the designer explores a given problem, making assumptions, setting boundaries and trying proposals based on her knowledge, both tacit and explicit, she encounters aspects of the problem that do not fit within her professional body of knowledge. Such is the character of wicked problems. When she meets these "surprises", she may ignore them or selectively inattend the signals that produce them - or she may *reflect-in-action*, carefully assessing the consequences and implications of her assumptions and actions based on the feedback she is receiving from the problem elements. She reflects about the thinking that created the particular stumbling block or opportunity. In so doing, she may restructure her frame for the problem, her understanding of the phenomena with which she is dealing, or her strategies and tactics. In Oxman's (1990) terms, she modifies her "prior knowledge" base to admit present learning. It is a process of online adjustment: "When we reflect in action we do so in the midst of action... Our thinking serves to reshape what we are doing while we are doing it" (Schon, 1987, p.26).

This type of reflecting, according to Schon, is a high-powered esoteric variant of the more familiar judgment and thought processes we use every day. For example, if we are trying to find an address in a strange neighborhood and turn down a dead-end street, we adjust our further moves to take account of the location of the street. We move in a different direction, learning from our mistake. The fundamental difference between design and this everyday example, however, relates to the now-familiar character of wicked problems. In the neighborhood search example, we move in relation to a fixed pattern of streets and houses. We need only reflect on our moves in relation to an objective and concrete problem structure. In wicked design problems, or "indeterminate zones of practice" as Schon calls them, the designer must also question the problem frame itself. Her "neighborhood" is an unstable and imaginary one which changes its form and structure according to the assumptions she has made. The process of evaluation and reflective response is thereby complicated. Basic to both everyday and design reflection, though, is the reassessment of actions and decisions in relation to the "backtalk" received from the problem situation and construction of a response in the form of new or modified moves. Each new move triggers additional implications and consequences and the process of reflection begins again. It is not a process of random, trial-and-error search, but rather a series of linked learning episodes, each building on the results from the last. According to Schon, reflecting-in-action is central to the artistry with which designers create appropriate responses and make sense of problematic situations. In these terms, learning is an essential part of creativity and hence of design.

Finally, building on the idea of ongoing learning introduced with reference to search in Chapter 3, the designer carries with him, to each new design episode, the knowledge he has gained from past experiences. Each surprise encountered, each reflective conversation and the change in approach it may entail, permanently alters his personal construct systems, that body of accumulated knowledge, beliefs, experience, values, education, preference and professional norms that he uses to make sense of the world around him (Low, 1982; Logan, 1989; Eckersley, 1990). His appreciative system becomes more refined, his bag of tricks larger. In terms of information processing theory, discussed above, the information encountered in each episode is encoded into permanent memory structures and classified and integrated with existing stores of knowledge. Hence, memory is in a constant state of dynamic reorganization as information structures accommodate the known to the new (Oxman, 1990). The new information, now "learned", becomes part of the generalized knowledge base and serves as prior knowledge in further design episodes. In this way, too, learning is fundamental to the process of design. Each new design process builds on and adds to past experience.

4.1.3 Subjectivity in Design

> When a practitioner sets a problem, he chooses and names the things he will notice (Schon, 1987, p.4).
>
> The act of design is primarily a judgmental process of making choices between alternative resources and strategies (Schon, 1987, p.13).
>
> The process of making decisions about the way things ought to be is very much influenced by the way in which the individual designer perceives his world (Martin, 1982, p.21).

At risk of belaboring the point, wicked problems are so labeled because of their messy, indeterminate nature. They change the color of their skin, so to speak, depending upon who is looking at them. The inherent subjectivity of the design process is what accounts for these different interpretations and the fact that designers, when faced with the same problem, will often select different things for attention, different approaches to solving it and different final solutions (Rowe, 1987; Schon, 1988; Eckersley, 1990).

To solve a design problem the designer must impose structure upon it (Powell, Evans and Talbot, 1982; Rittel and Webber, 1984; Glynn, 1985). He does so "through countless acts of attention and inattention, naming, sensemaking, boundary setting and control" (Schon, 1987, p.30). It is this process of naming and framing that is inherently subjective. The designer's personal construct system shapes his interpretation of the problem and the choices he makes with respect to it. To paraphrase Powell, Evans and Talbot (1982, p.246), what the designer believes about the world shapes the "facts" he perceives. Schon (1987) goes further to suggest that the word *perceive* is too passive to reflect the true nature of the designers' act: the practitioner *construes* his own version of reality, he *constructs* the situations of his practice. Facts are prestructured by the theories implicit in the act of perception itself (Glynn, 1985). And while this point reiterates what was said in Chapter 3 about the role of schemas in search activity, it is important to give it additional emphasis here, as it applies to design. Design requires *new* interpretations and *new* frameworks of thought - new schemas - for novelty to emerge. The designer's success in achieving new schemas will depend in large part on information processing capabilities: these vary from person to person. The personal characteristics of the designer are central to problem framing and hence design.

The concept of cognitive style is used to summarize the notion that each designer has typical ways of perceiving, remembering, thinking and problem solving:

> Each individual designer has preferred ways of organizing all that he/she sees, remembers and thinks about. These consistent ways of organizing and processing information and experience are cognitive styles. These styles represent consistencies in the manner or form by which cognition takes place (Martin, 1982, p.13).

Cognitive style does not operate independently from other personal characteristics such as personality, education, values and beliefs; together, they shape the design process. It is distinctive, though, in its emphasis on how the designer thinks about a problem and how he processes information: Does he approach the problem of designing a city from the neighborhood up or from city-scale down? Does he break a problem into parts to solve it or does he attempt to treat it as a whole? Does he immediately form a tentative solution or does he spend time in preliminary analysis? How the designer answers these questions will shape both the nature of the design process and the nature of the final design form (Martin, 1982; Cross, 1983; Rowe, 1987; Portillo and Dohr, 1989; Eckersley, 1990). The way in which he processes information will shape how he approaches the design problem.

Empirical evidence suggests that cognitive style will affect the designer's ability to process extensive or complex information, to recall appropriate information and to translate specific case-related information into an abstract generalized knowledge base (Driver and Streufert, 1969; Bass, 1983; Bray, 1988; Portillo and Dohr, 1989). Whether the individual has simplistic or complex thought processes has a profound influence on the nature of problem-solving activity he engages in. "Complex" thinkers routinely seek more than one solution, and are more apt to innovate and engage in rigorous analysis than simplistic thinkers. In fact, evidence suggests that simplistic thinkers often miss high-quality, relevant solution forms in their quest for one "right" answer (Suedfeld and Streufert, 1966; Portillo and Dohr, 1989). In one sense, then, cognitive style is the means that allows the designer to select while analyzing the problem (Curtis, 1986). Yet, it also sets real limits on the questions the designer can ask and constrains what is possible in solving the design puzzle.

That different designers do think differently emphasizes the subjective elements within design that constrain the designer's approach to the design problem. In contrast to what Willem (1988) calls "hard" constraints, or required attributes that are clear and binding (e.g. cost limits, site elevation, drainage pattern), these "soft" constraints are derived from taste, style, preferences, norms, values, methods, strategies and other subjective criteria. As *autonomous* or *independent* constraints, they do not stem directly from the task environment. Nonetheless, they do translate into profound shaping influences (Lawson, 1980; Rowe, 1987; Schon, 1987). Soft constraints are loosely binding logically but *severely* binding personally (Gross and Fleisher, 1984). They serve to impose an order on the task environment and set bounds to the search and design space.

The question that comes immediately to mind is how we can be sure a designer, in a particular situation, is framing the problem "correctly", that he has not missed some important clue in the design problem or that there is not another frame that would provide an equally valid or better approach. In Marples' (1960) words, it seems likely that the examination of a problem through one and only one problem frame gives a very biased view. The implications of subjective biases for the generation of alternatives within a rational planning framework have been touched on in Chapters 1 and 2 and will be further explored in Chapter 6. At this point, let it be noted that subjectivity in design is a powerful inducement for conscious and explicit development of a wide range of possible solutions as a means of offsetting personal bias. In fact, concern for safeguarding the integrity of the design process from personal bias, and exposing the assumptions of individual designers to deliberate and rigorous analysis, has been a source of long-standing concern in the design literature. It must be emphasized, though, that subjectivity in design is necessary and inescapable. It cannot be dispensed with, but it must be acknowledged and dealt with.

4.1.4 Design as a Social Process

> Design is a social activity that takes place among people who negotiate, make proposals, set rules for

> their conduct and for the work to be done and follow such rules (Habraken and Gross, 1988, p.150).

For professions like planning and architecture, the social nature of design is a fact of life. More often than not, a particular problem is tackled by groups or teams of individuals, sometimes sharing specialized backgrounds, but more often brought together because of their differential areas of expertise.[4] They must communicate, they must negotiate, and they must reach an appreciation of the different frames of reference that each brings to the common task (Bass, 1983; Jones, 1983). The benefits of group decision-making are clear: an increase in the number and quality of alternative solutions (Bass, 1983; Harrison, 1987; Kirk and Spreckelmeyer, 1988). In fact one study suggests that the use of multidisciplinary groups yields from 65 to 95 percent more ideas than a single person, working alone (Dell'Isola, 1982). The general point is of obvious relevance to the development of design methods and strategies. At the same time, the divisive nature of problem-solving processes involving inter-specialty or inter-organizational collaboration is well documented (Skelcher, 1982; Bass, 1983; Bayne, 1986; Harrison, 1987). Specialization breeds compartmentalization, which leads to competitiveness and infighting in the larger group as individuals strive to protect their own exclusive domain. There is evidence to suggest that innovation may be hindered as a consequence (Bass, 1983). This point will be of concern to the discussion of the Mill Woods case study, where the Edmonton planning department sought commitment and approval from a number of specialized interests and departments within the civic administration.

Overall, the social nature of design means that the design team must reconcile conflicting frames of the design problem in an attempt to generate design solutions. They must collaborate and they must cooperate.

4.1.5 Design as a Paradox

> Design is making sense (of things)... Making sense always entails a bit of a paradox between the aim of making something new and different from what was there before and the desire to have it make sense, to be recognizable and understandable (Krippendorf, 1989, p.9)

What distinguishes design from art is its essentially practical purpose in solving a problem, filling a need, or enabling action (Cross, N., 1986). It almost goes without saying that a design solution must be relevant. It must be appropriate to its intended use and context. For applied disciplines like planning and architecture, this means that the design must be socially appropriate, fitting within existing social frames of awareness and understanding. Here, in this need to make sense, lies the paradox of design: how to reconcile the different and the novel with the historical continuity of what already exists. It necessitates balancing the courage to fly in the face of accepted wisdom with a sense of what it is possible for people to do under given conditions (Hiesinger, 1983; Kraushaar, 1988). Design involves challenging the limits of understanding and awareness while still remaining comprehensible.

In terms of the process of design, the paradox relates to the cognitive and perceptual processes that enable the creation of novelty. We have descriptions and names for what goes on: "Creativity is a matter of discovering new relationships between existing data patterns stored in long-term memory" (Smith, 1974, p.237); "Design is a dynamic process of adaptation and transformation of the knowledge of prior experiences in order to accommodate them to the contingencies of the present" (Oxman, 1990, p.18); "Creativity is enhanced by the ability to generalize to a high level of abstraction" (Oxman, 1990, p.27) - but no real understanding of what enables the stretching of perceptual limits. All of the descriptions of creativity, in varying degree, come down to that irreducible core of "black-boxism"; there is an element of design that is ill-understood, cannot be predicted, and perhaps cannot be subjected to the designer's control. Knowing that the right brain is involved in deriving new symbols and codes to process incoming information does not explain how the codes are formed. Knowing that connections between consensual patterns are rerouted so as to be consistent with new information does not explain what triggers the rerouting, why it happens when it does or what makes the new connection relevant. And knowing that information is stored in highly abstracted and generalized hierarchies in long-term memory does not explain why or how information is stored the way it is and why some individuals store and retrieve information better than others. The key to the process that enables the creation of novelty from what already exists remains a mystery: "Of all the questions we ask about design, the matter of what goes on inside the designer's head is by far the most difficult and yet the most interesting and vital" (Lawson, 1980, p.24). The paradox of design translates, in the design process, to the inescapable fact of black-boxism.

Despite this core of mystery, significant advances have been made in understanding the overall nature of design activity. Empirical evidence suggests that even partial understanding permits the designer some control over the quality of both the design process and design solutions. Kirk and Spreckelmeyer (1988) demonstrate the effectiveness of creativity-enhancing design methods for improving the creative output of design teams. Edwards (1986) shows how drawing techniques improve the ability of students to use right brain, non-verbal processes and thereby to create new or novel ideas, insights and discoveries. And Eckersley (1990, p.267), while observing that "we do not actually know very much about the operation of heuristics" in design, goes on to demonstrate how their introduction to the design process improved the effectiveness of a group of novice designers assigned a specific design task. When given particular heuristics to employ, the 28 subjects were able to bypass extraneous issues and information and focus more quickly on relevant solutions; problem solving was more efficient. Clearly, then, even acknowledging the essential mystery in creativity, theoretical and practical advances in design knowledge are possible. Evidence suggests that what designers are observed to be doing, what they say they are doing and what design methodologists say they should be doing are all important aspects in an investigation of design and its subsequent application to an urban planning framework.

4.2 The Design Process

As part of such an investigation, it is necessary to focus on the nature of the design process as the series of actions or operations that the designer performs in the quest for new form. Over the last thirty years, attempts have been made to describe the design process in both prescriptive and descriptive terms. Discussion here focuses on two leading concepts:

1. Analysis-Synthesis-Evaluation Model
2. Conjecture-Analysis Model

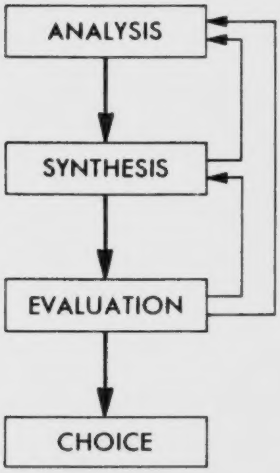
4.2.1 Analysis-Synthesis-Evaluation Model

The first prescriptive model of the design process came in response to concerns within the fledgling design methodology movement of the early 1960s. It was said that traditional design approaches, with their core of craft knowledge, were inadequate to the complexity of modern design tasks (Jones, 1963; Archer, 1963). There was common concern for increasing both the efficiency and the reliability of the design process.

In 1962, Christopher Jones proposed a three-stage model which was intended to have two principal effects:

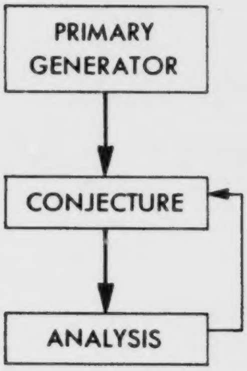
1. to reduce the amount of design error, re-design and delay;
2. to make possible more imaginative and advanced designs (Jones, 1963).

This framework, which has come to be known as the analysis-synthesis-evaluation model (Figure 4), is important to current considerations of the design process for a number of reasons.


ANALYSIS
SYNTHESIS
EVALUATION
CHOICE

Source: Adapted from Jones, 1981

Figure 4: Analysis-synthesis model of the design process


PRIMARY GENERATOR
CONJECTURE
ANALYSIS

Source: Adapted from DARKE, 1984

Figure 5: Conjecture-analysis model of the design process

First, it is characteristic of the so-called systematic methods movement which preoccupied many design theorists for some fifteen years. This, alone, makes it worthy of serious attention. Second, the vigorous debate engendered by the model has led to significant advances in our understanding of the design process. Third, Jones's approach promotes the development of many alternative solutions as opposed to the creation of a single answer. At least superficially, then, it supports a rational planning framework. Fourth, as will be demonstrated, the model continues to exert a powerful influence despite strong opposition from a key group of design theorists. Its persistent appeal lies in its clear, explicit isolation of the three critical activities in design thought. Finally, the analysis-synthesis framework merits attention because its principal aim is still sound: to devise a process that reconciles the creative and intuitive elements of traditional design with the explicit and rigorous logical analysis necessary to modern design tasks. This intention to supplement rather that supplant traditional methods has been overlooked by many critics of the model. Nonetheless, the need to infuse the process of creativity with deliberate analysis and reflective thought was a driving force thirty years ago, and remains a necessary focus for design theorists today.

Jones's model is based on what he refers to as one of the simplest observations about designing - that the designer breaks a problem into pieces, puts the pieces together in new ways, and then tests to discover the consequences of the new arrangements (Jones, 1981, p.63). The method proposes "to leave the mind free to produce ideas, solutions, hunches and guesswork at any time without being inhibited by practical limitations and without confusing the process of analysis" (Jones, 1963, p.10). According to Cross (1984, p.2) it provides a rational framework within which the irrational has a place.

The first component, analysis, extends the perception of the design situation so that the designer has "a large enough, and fruitful enough" space in which to seek a solution (Jones, 1981, p.64). The designer deliberately tries to rid himself of preconceived notions by introducing a vast amount of information. Evaluation is deferred and no pattern or system is imposed to order the facts. The purpose of extensive problem analysis and exploration is to avoid narrow biases and to recognize the essentially unique qualities of a wicked problem: "Part of the art of dealing with wicked problems is the art of not knowing too early which type of solution to apply" (Rittel and Webber, 1984, p.141). The analysis phase reflects Jones's (1983) philosophy that unlearning is the essence of design.

Synthesis is the stage of pattern-making where the designer decides what to emphasize and what to ignore. Problem boundaries are fixed, important variables and constraints set, and interpretive judgments made. The designer adopts a particular frame for the problem and reaches into his creative reservoir to generate a number of potential solutions which fit the frame. Creativity is the essence of the synthesis stage. The purpose of evaluation is to reduce the range of options identified during synthesis to a single choice of design strategy using a rational and systematic procedure.

Again, it is necessary to emphasize that although the analysis-synthesis approach has been often misinterpreted by its critics as a strictly linear and sequential organization of design thought (Lawson, 1979; Grant, 1986; Rowe, 1987; Hyde, 1989), this was not Jones's intention. He stressed that the designer's mind "must be free to jump about in any sequence, at any time, from one aspect of the problem, or its solution, to another, as intuitively as possible" (Jones, 1981, p.xx). At the same time, to keep control over the design task, he proposed that the designer had to maintain a meticulously ordered system of external notation which was to reflect the basic activities of analysis, synthesis and evaluation occurring internally: "One's mind, though not one's paper-work is best kept in constant intermingling of both problem and solution" (Jones, 1981, p.xxiii). Here, in the different internal and external mechanisms, lies the main source of confusion over the analysis-synthesis-evaluation model.

In the time since Jones's original formulation, attempts have been made to incorporate a more explicit recognition that design does not proceed like a muletrain. In all of these attempts, the overall progression of the process is forward toward solution but allowance is made for backtracking to earlier stages. In this vein, Zeisel (1981) sees design as comprised of linked cycles in a spiral process:

1. Designers seem to backtrack at certain times - to move away from, rather than toward, the goal of increasing problem resolution.

2. Designers repeat a series of activities again and again, resolving new problems with each repetition.
3. These apparently multidirectional movements together result in one movement toward a single action (Zeisel, 1981, p.14).

In similar terms, Hickling (1982) speaks of a "cyclic whirling" process. Rowe (1987, p.34) describes a "distinctly episodic structure", where the designer conducts "a series of related skirmishes with various aspects of the problem", backtracking to earlier stages as the need arises. Each episode moves him iteratively toward a final solution form.

On the basis of these descriptions, it seems safe to conclude that although the names of the stages have been changed and descriptions fleshed out to acknowledge intricacies and subtleties in design thought, the analysis-synthesis framework remains central to many recent descriptions of the design process. Lang (1987) describes an iterative framework of "intelligence", "design" (i.e. alternative generation), "choice" and "post-evaluation", and Gasparski (1990) one of "identification", "interpretation" and "measurement/assessment". These recent models explicitly stress flexibility to accommodate the "irrationalities" of creative thought and a multiplicity of participants, and recycling to accommodate on-going learning. With regard to the latter, a model by Kirk and Spreckelmeyer (1988) incorporates a stage of "synthesis" after evaluation to allow for a reworking of alternatives in terms of what is learned during the formal assessment phase. These descriptions of the design process explicitly acknowledge the complexity in design.

Another criticism of the analysis-synthesis framework has centered on its requirement for extensive problem exploration and analysis prior to solution development. Yet, the rationale behind this requirement is simple enough. The designer wants to be sure he is solving the "right" problem: "There are plenty of good designers who have no difficulty at all in producing the right answers, if only they had asked the right questions" (Archer, 1963, p.66). Extensive, preliminary problem analysis is done in deference to both the complexity and the essential uniqueness of design problems. If the problem is not well understood, how can it be well-solved? And once the designer fixes the nature of problem components in his mind, any further analysis of the problem will be constrained by this fixed frame of reference:

> We sometimes forget how deeply the nature of an object is determined by the nature of its components. Once you decide that a car is to be made of four wheels, engine, chassis, and superstructure, there are really few essential changes you can make (Alexander, 1963, p.34).

Each way of stating the problem sets boundaries for the range of solutions possible (Jones, 1983). Just as with search activity, solutions based on too little preliminary analysis run the risk of molding problem understanding to fit the available solutions (Lynch and Hack, 1984; Ingraham, 1987).

Nonetheless, critics of the analysis-synthesis model argue that extensive preliminary analysis is an unrealistic approach to wicked problems, which they say cannot be understood except in terms of potential solutions (Lawson, 1980; Darke, 1984; Rittel and Webber, 1984; Broadbent, 1986). They suggest that problem understanding must emerge through an exploration of the design situation in relation to a particular solution concept; that only by observing and experimenting with how a solution fits or does not fit particular aspects of the situation will the designer come to appreciate the true nature of the problem. In this sense, a proposed solution forms a point of entry into the problem space.

These critics also suggest that the analysis-synthesis framework does not describe the way designers actually approach design problems. Lawson (1979; 1980) compared the performance of fifth-year architectural students and fifth-year science students on a series of problems involving colored blocks. He discovered that the two groups approached the tasks very differently. While science students used a "problem-focused" strategy aimed at uncovering the problem structure, architectural students adopted a "solution-focused" approach where repeated solution attempts were made until one proved acceptable (i.e. trying a solution and seeing where it went wrong). This led him to conclude that designers do not operate according to an analysis-synthesis framework:

> The implication is that designers' methods are quite different from scientists' methods. The architects had learned that the most successful (or practicable) way to tackle design problems is by proposing solutions to them; in this way one discovers more about the problem and what is an 'acceptable' answer to it. The scientists had learned to analyze a problem and to attempt to discover its 'rules' before proposing a solution to it (Cross, 1984, pp. 170-171).

Lawson argued that his results support a wicked-problem view, and that it was fully reasonable for designers to have developed a methodology that does not depend on the completion of problem analysis before solution can begin. In terms of solution quality, however, the two groups of students in Lawson's study performed equally well, although they committed different types of errors. And despite Lawson's argument that the architects' approach is more fitting for wicked problems, this was not expressly tested in his study since the colored block problems that the students addressed were well-structured.

Akin's (1979) experiments, using protocol analysis to record the behavior and spoken thoughts of designers, also indicate that architects favor a solution-focused approach.[5] His subjects interspersed analysis through virtually all phases of the design process and attempted solutions very early on in their protocols. These solutions, according to Akin, arose from limited analysis of the problem situation. Darke (1984) reported similar results. She observed design to be a process of "variety reduction", with the large number of potential solutions reduced almost immediately by external constraints and by the designer's own cognitive structures. Similarly, Rowe (1987) documents design solutions coming very early in the design process and exerting a dominant influence over all subsequent problem-solving directions. The obvious conclusion to be drawn from this body of research, according to critics, is that systematic procedures are at odds with what designers actually do. Yet, as Cross (1984, p.173) remarks: "It would be tautologous simply to argue that conventional designing is unlike systematic designing; the systematic procedures were developed specifically to be a change from conventional design practices, which were seen to be inadequate to the complexity of the tasks facing modern designers".

4.2.2 Conjecture-Analysis Model

The conjecture-analysis model (Figure 5) incorporates a solution-focused approach. It proposes that a design develops by gradual refinement from an initial conjecture which the designer imposes on the problem to direct his analytic task. A few cues in the environment are sufficient to evoke a pre-compiled solution in the mind of the designer (Akin, 1984). Understanding of the problem is gained by testing the conjectured solution against the requirements of the design situation. Throughout the iterative process of testing, the conjecture is not rejected unless there is a glaring mismatch with the detailed requirements of the design situation (Lawson, 1980; Darke, 1984). In a sense, then, the design is conceived in "embryonic totality" at the beginning of the exercise and fleshed out through subsequent analysis of the problem (Smith, 1974). The process is one of bringing one solution into progressively sharper focus. According to Darke (1984), the concept of the primary generator is central to understanding how the designer is able to narrow down the problem space so quickly:

> The concept or objective that generates a solution is here called the *primary generator*. It can, in fact, be a group of related concepts rather that a single idea. These objectives form a starting point for the architect, *a way in* to the problem, he does not start by listing all the constraints... it is usually more of an article of faith on the part of the architect, a designer-imposed constraint, not necessarily explicit (Darke, 1984, p.181).

The term "primary generator" does not refer to the solution image but rather to the ideas that generate it. Primary generators are strongly valued and self-imposed on the basis of the designer's subjective judgment.

Questions of where the conjecture comes from or why it, rather than another, is brought to the foreground of the designer's consciousness, remain largely unanswered in accounts of the conjecture-analysis model. Smith (1974) suggests that the solution arrives by the designer's "innate sensibility". Hillier, Musgrove and O'Sullivan (1984) speak of the designer's knowledge and experience as critical factors. Earlier discussions of information processing and perceptual schemas provide plausible accounts of what occurs on a cognitive level but shed little light on the type of information that a designer possesses, the form it is in or the nature of the skill he uses to manipulate it. Nor do discussions of the conjecture-analysis framework say much about the nature of the analysis that occurs once the conjecture is proposed. In this sense, staged-process models like the two discussed here enhance understanding of the design process somewhat but provide no direction to the practitioner seeking more control over the design task. Such control emerges only through understanding the types of thought subsumed within the broad-brush descriptions such models have provided.

4.3 The Inner Logic of Design

> We see the inner logic of designing as the structure of a dialogue between the architect's appreciation of a site on the one hand and his images, prototypes and principles on the other (Porter, 1988, p.169).

A number of authors do offer some insight into the nature of underlying thought processes (Schon, 1987; 1988; Goldschmidt, 1988; Porter, 1988; Oxman, 1990). They do so, however, not from the confines of any particular staged-process model, preferring to speak of what professional practitioners know, how they reason and how they relate their knowledge to particular design situations (Schon, 1987; 1988; Porter, 1988; Goldschmidt, 1988; Oxman, 1990). To paraphrase Lawson (1980), knowing the phases of the process will no more enable a designer to design than being able to recite the movements of the breaststroke will prevent a swimmer from sinking in a pool. It is the way the designer breathes life into the task that is fundamental to understanding the "how-to" of design.

The discussion to follow, like much in this thesis, draws heavily on developments in the field of architecture. This becomes more obvious here, though, as authors move to give practical substance and application to abstract cognitive processes. Perceptual schemas and information processing systems are given concrete definition through the interlocking concepts of types, rules, knowing-in-action and reflecting-in-action. In any event, the architectural framework, in its emphasis on spatial form and virtual worlds (representations of the real world through drawings, diagrams and models), is equally apt to much of what urban planners do. The planner's definition of site may be different from that of the architect (i.e. the factors that are considered important) as will be his prototypes, but the inner logic of the process will remain the same.

The basic principles of Schon's (1987) knowing-in-action and reflecting-in-action were outlined earlier, but two aspects of the framework require elaboration here. First, central to the way the designer frames a situation is his skill in relating the features of a problem to his existing knowledge. Through "a kind of instant perceptual problem-solving", the designer constructs a design world:

> These are the environments entered into and inhabited by designers when designing... They act as holding environments for design knowledge. As a designer brings understanding, strategies and images to a particular design situation, conducts a dialogue with that situation and constructs in it a version of a more or less familiar design world, he instantiates a particular set of things to think with (Schon, 1988, p.182).

Thus, the designer does not frame a problem without analyzing it. That may not be apparent, however, because his knowledge and skill enable him to perform the necessary analytic functions very quickly. This explanation is supported by empirical research which documents the different approaches to problem solving by novice and expert designers (Simon, 1977; Lawson, 1980; Goldschmidt, 1988; Bray, 1988). Novices spend a lot of time in explicit analysis and exploring the obvious while experts derive a solution very quickly. It is not necessarily, as Akin (1979) and Darke (1984) suggest, that these experts are able to evoke a precompiled solution on the basis of a few cues in the environment, but rather that they are able to process the entire situation rapidly and efficiently.

The second aspect requiring elaboration is the relationship, in design reasoning, between a unique design situation and a designer's general knowledge base. How is it that the designer is able to relate his existing knowledge to the present task? According to Schon (1988), Porter (1988) and Oxman (1990), this becomes possible when the designer "sees" the present situation "as" something already present in the repertoire within his internal memory. By invoking a type or model, the designer is able to see how a possible design move might be matched or mismatched to a situation, even when the designer cannot say with respect to what the match or mismatch occurs. As noted in Chapter 3, types and models serve as examples to follow. They imply rules and relationships between elements that are essential to the overall solution form. In the search process, they might serve as end states, whereas in design they act as intermediate premises that trigger a further round of design reasoning. In architectonic terms, these types might be particular buildings or kinds of buildings or functional types such as civic plazas or suburban libraries. For residential planning, they might be as general as "the new town concept" or as particular as one new town scheme, such as Columbia, Maryland or Erin Mills, Ontario. Particular rules governing the socioeconomic composition of the community, maximum size of neighborhoods, housing types, and location and spacing of service facilities are implicit in the choice of the type. The important point is that the invocation of type begins the designer's transaction with his problem:

> It is our capacity to see unfamiliar situations as familiar ones and to do in the former as we have done in the latter that enables us to bring our past experience to bear on the unique situation (Schon, 1987, p.67).

It is also the vehicle that permits the designer to expose a problem's uniqueness. This is because design situations both invite *and resist* the importation of type. To reiterate, reflecting-in-action is the process that ensures that points of resistance are taken into account. As the designer applies types and rules to the design task, he encounters surprises which cause him to rethink his framing of the problem. The adequacy and utility of his frame is thereby discovered in action. He strives to make the situation conform to his frame yet responds to evidence of its failure to do so. This reflective response is the hinge pin on which successful design depends. According to Jones (1983), it determines the integrity of the overall design process.

The empirical research of Schon (1988) and Porter (1988) is worth detailing in its illustration of the use of types and rules as elements in the designer's reasoning process.[6] They asked seven designers to work individually on a "footprint" of a suburban branch library The results indicate that in completing the assignment, all of the participants reasoned their way from premises, in the form of types and rules, to conclusions. Yet the different designers, all given the same description of the design task, construed the problem in different ways. They made use of different rules and types which led to sometimes different and sometimes similar judgments. Even when they selected the same rules they often used them to arrive at different judgments. The designers' overriding reference in the process, without exception, took the form of "spatial gestalts", or visions of coherent wholes. They used these overarching concepts to reason their way through the process, invoking other more circumscribed rules and types as the need arose. In selecting a gestalt, different designers made use of different contextual information and hence arrived at different overall spatial form. These results clearly support the earlier characterization of design as a subjectively-based learning process, but they go beyond descriptions presented earlier in the chapter in their ability to lend concrete substance to elements within design reasoning: types and rules.

A final point must be made about the use of types or rules as entry points into a design problem. Although, at a superficial level, the discussion seems to imply that final solutions are simply adaptations of existing types, the approach does not rule out the creation of completely novel form. According to Goldschmidt (1988, p.242), the rigor of the designer's experimentation process is a critical factor: designers who "experiment with their material intensively enough" leave the potential for new discovery wide open. In a similar vein, Oxman (1990) identifies a prototype continuum for design generation, ranging from routine design (i.e. search), through adaptive design, to original design. In the last case, prototypes serve as springboards for novelty:

> Our assumption is that creative derivations are based on particular structures of knowledge which share high-level concepts which may be common to several prototypes. A resultant restructuring and reorganization of knowledge can occur which, in effect, generates a new prototype. This formulation appears to be germane to the explanation of the exploratory processes of creativity (Oxman, 1990, p.22).

In this sense, the high-level abstraction of knowledge from prototypes enables the application of existing knowledge to the problem while permitting completely novel transformations to occur. In terms of the framework outlined for this thesis, then, types and rules are central to both adaptation and novelty. Harking back to Chapter 3, the process with which each begins is search:

1. On a cognitive level, for problems in which the designer has great experience and facility with related information.
2. Externally, through a range of sources outside of the designer's own cognitive structure when his experience and knowledge is limited.

The implications for integrating the overall tasks of search and design within the generation of alternatives stage of the planning process are explored in Chapter 6.

4.4 Design in Practice

Throughout the above discussion, practical examples have been presented to highlight the specific points addressed. Here, further empirical research is detailed, not so much to illustrate particular aspects of design theory as to indicate areas of incongruence between theory and practice. This is essential if theory is to be relevant to the trials of real-world settings.

4.4.1 Inadequate Analysis

Central to the conjecture-analysis framework is the notion that the initial solution or problem frame serves as a springboard for analytic activity. The designer treats his preconceptions as hypotheses to be disproved, such that analysis is a matter of devising bases upon which to attempt refutation (Broadbent, 1986). In practice, however, the designer is seen to subject his "pet idea" to rather less analysis than the theory suggests. Akin's (1986) three case studies of design activity, based on protocol reports from designers, confirm that designers do, indeed, select only one solution for detailed development. More significantly however, in Akin's study, the selection each designer made was *never* altered or reversed. Are designers, then, so accurate and astute in their interpretations of the design situation that they never err or need to rethink early suppositions? Rowe's (1987) investigation suggests not:

> Even when severe problems are encountered, a considerable effort is made to make the initial idea work, rather than to stand back and adopt a fresh point of departure... In case studies, we can see some very real distortions of otherwise systematic procedures in these attempts to adhere to the 'big idea' (Rowe, 1987, p.36).

Other studies also suggest that the designer carefully exempts his pet idea from scrutiny to the detriment of the entire problem-solving exercise. He ends up "trying to make a solution work that should have been abandoned long ago, spending valuable time patching and bending things into shape where they should have fallen into place" (Mann, 1987, p.597). Reluctance to abandon already invested effort and a strong practical commitment to the conjectured solution make rigorous analysis unlikely (De Bono, 1968). And if the designer is honest enough to acknowledge weaknesses in his conjecture at some late stage in the process, he is left scrambling to devise another concept on the basis of scant preliminary analysis. According to Lawson (1980, p.153), the designer has fallen into the "category trap": the tendency to categorize the problem in solution terms before it has really been studied.

Strongly linked to these shortcomings in practice, there have been renewed calls for extensive problem analysis *before* a solution is attempted (Jones, 1983; Ingraham, 1987; Kirk and Spreckelmeyer, 1988; Nadler, Smith and Frey, 1989). This supposedly eliminates the risk that analysis will be undertaken solely to confirm the designer's own favored theory, rather than to uncover the "true" problem structure. At the same time, Jones (1983,pp.58,60) advises that the designer must balance the need to order the design situation quickly with the need for complete understanding:

> Perhaps the most important ability to develop in designing is that of being exceptionally skeptical of one's own ideas, especially those which occur at the start, while not losing the capacity to proceed with the problem despite the initial absence of an organizing idea of what the solution is likely to be.

In the final analysis, the skill that must be fostered is attentiveness to context. Supposedly, both of the process models discussed in this chapter promote such attentiveness, albeit at different points in the overall design process. But in practice, most analysis degenerates into half-baked attempts, with the designer sometimes hiding an implicit favorite while pretending a thorough approach (Mann, 1987). It would seem that many designers are not convinced of the benefits of thorough analysis - or perhaps there are conditions in the real world that make it difficult to ensure that it is carried out.

4.4.2 The Setting for Professional Practice

Design occurs within particular institutional and organizational settings which affect the operation of the design process. First, the designer is faced with time constraints which set real limits on his capacity to "create": Will his flash of insight strike before the management deadlines expire? Moreover, he may be involved in several projects simultaneously, each at various stages of completion, all competing for his attention (Mann, 1987). In terms of search and design, this means that the designer will restrict the number of solutions he seeks and will attempt to find a "pre-compiled" solution before he undertakes creative activity. Mintzberg, Raisinghani and Thoret (1976) found that in 22 of 25 public decision-making processes, the greatest amount of time was spent in search for a single satisfactory solution. Only when one was not found was design undertaken. Then, in 20 of the cases that required some design, only one resulted in true innovation; the others relied on modifications of existing form. In practice, search and design seem to be sequential rather than parallel processes, with adaptation playing a much larger role than truly innovative design (Van Gundy, 1981; Kendall, 1989). It would seem that problem-solvers seek to manage organizational and cognitive strain by restricting the number of alternatives sought and the manner in which they are generated. The process begins with consideration of obvious solutions and moves on to other possibilities only if those are deemed unsatisfactory (Bass, 1983).

After reviewing designers and design environments in 138 organizations, Ughanwa (1988) identified a number of organizational factors judged by designers to bear significantly on their successful performance. Most significantly, 93 percent of those involved in the study specified "management effort" to be the most important overall stimulus to effective design. More specifically, the following were isolated as key factors:

1. Support of top management involvement and commitment of sufficient resources for the design project.
2. Favorable attitude toward innovation on the part of management.
3. Employment of the "best" designers in terms of education, training, experience and demonstrated talent.
4. Willingness to utilize "outsiders" to supplement staff.
5. Effective cooperation, coordination and communication among team members and explicit development of rapport and team spirit.
6. Avoidance of compartmentalization within the design team.
7. Clear definition of objectives, targets and guidelines.

4.4.3 Diversity of Process

A final lesson from practice suggests rather more diversity in design style and process than one would expect on the basis of comment from conjecture-analysis proponents. It would seem that designers utilize different design processes and carry out their activities in different orders, depending on a variety of contextual and personal factors. While some impose a solution concept very early in the design process, others spend a long time in analytic activity, building up an interpretation little by little (Goldschmidt, 1988). In Davies and Talbot's (1987, pp.20-21) interviews with 35 eminent United Kingdom designers, one described the process as a struggle with "this terrible porridge" that he must wade through to achieve "the idea". Another likened it to "peeling onions, it involves some tears". Still others described a sudden knowing that might happen so early in the design process that "you think, by God! That was easy..." Some designers are wide open to learning and change throughout the process, others are not (Goldschmidt, 1988). Some are dominated by problem-oriented constraints and others by external ones brought to bear solely as a means of imposing order (Rowe, 1987). The implications for a theoretical understanding of design are clear:

> It is here, in the give and take of problem-solving situations in the real world, that we start to see the complex texture of decision making. And it is here that we discover there is no such thing as *the* design process in the restricted sense of an ideal step-by-step technique. Rather, there are many different styles of decision making, each with individual quirks as well as manifestations of common characteristics (Rowe, 1987, p.2).

Design process theory must be responsive to this diversity. It must be flexible enough to accommodate the range of different strategies, methods, cognitive styles and overall approaches that designers require by virtue of contrasting personal make-ups and diverse decision-making tasks. Yet, at the same time, theory must provide normative guidance - not necessarily *how* the process should be staged but rather what types of thought, knowledge and skill are critical to effective design.

4.5 Conclusions and Importance to the Thesis Problem

It was noted in Chapter 2 that some planners view the creative element in generating alternatives as a threat to the rationality of the planning process. In particular, Alexander

(1982, p.283) remarked that if creativity is a significant component of solution generation, "then perhaps the limits of rationality in decision-making are narrower than even its most pessimistic critics thought". The accuracy of this claim can only be assessed against a background of information about the nature of design and the design process. This chapter has provided such a backdrop. A number of key points necessary for relating design to an urban planning framework emerge. First, there is no infallibly correct process or sequence of operations that will guarantee effective solutions. Questions of whether alternatives develop from a conjecture-analysis framework or an analysis-synthesis one are decidedly less important than whether the overall approach is rigorous in ensuring a fit between problem and solution. Attentiveness to context, the ability to read and interpret the intricacies and subtleties of setting and site, is critical to ensuring this fit.[7] The designer must treat the design episode as a learning process which affords him the freedom to test and experiment, to reflect and to respond to the unique features of the problem. Adequate analysis is necessary before solution is attempted, but the question of what is adequate will evoke a different response depending upon the particular blend of ability, education and experience a designer brings to the design task. The appropriate degree and staging of analysis within the process will also shift according to the nature of the problem: Is it similar to one the designer has seen before? Does it require innovation or will adaptation suffice? According to Powell, Evans and Talbot (1982), the analysis-synthesis framework is better suited to situations requiring absolute newness, whereas conjecture-analysis offers an acceptable fit with those requiring adaptive response. The quest for recipe-like structures to govern the designer's ordering of analytic, synthetic and evaluative functions has been misguided. Instead, controlling and varying the design process according to context and problem structure is one of the most important skills a designer must develop.

In addition, design hinges on creativity, an essentially black-box process that is based in large part on powerful internal systems of information processing and synthesis that we cannot directly observe or fully comprehend. A significant part of the designer's creative ability, the "artistry" with which she makes sense of "indeterminate zones of practice", centers on a tacit knowledge that does not depend on her being able to explain or describe what she knows or how she performs the design task. The inherent mystery of this artistry sets limits on our understanding of the design process and affects the manner in which design must be learned and taught. It complicates the way designers in a group process relate and interact on the same problem. In essence, the study of design itself becomes a design problem. The framework is ill-defined; boundaries are not fixed and identification of key variables is uncertain. How one views design, its make-up and its role within the generation of alternative stage shapes one's overall conceptualization of the design process. Yet at the same time, by treating the conceptualization as a global experiment, attending feedback from practice and from the needs and constraints of a particular discipline, reflecting on and reshaping the frame to fit the results of the experiment, one ensures a meaningful interpretation. No doubt, creativity is the principal complicating factor in design and, hence, in the generation of alternatives process. Accommodating the difficulty becomes an essential task for theorists and practitioners alike.

The final point to be made here relates to the relationship between design and search. A good deal of the discussion in this chapter (and in the literature from which it is derived) draws clean-cut distinctions between well-defined and wicked problems and between search activity and design. The distinctions are made, no doubt, in the interest of conceptual clarity. They are potentially misleading, however, a profound oversimplification of the nature of the generation task. First, the designer has no a priori knowledge of whether or not a problem is well-defined or wicked or if it will be satisfied by existing solutions or requires design. Rather, this knowledge comes through the process of framing and reflecting, seeing the problem *as* another and assessing areas of match and mismatch with prototypic solutions. Being open to surprises and being ready to reshape understanding of the problem in response to these surprises means that the designer approaches every problem as potentially wicked. Yet at the same time, it is only by treating the problem, initially, as clearly defined and amenable to application of his existing knowledge and repertoire of solutions that he gains the prerogative to explore its wickedness.

It is thus, through the application of existing solutions to unique situations, that the activities of search and design become intertwined. The individual assesses a problem situation in relation to existing stores of knowledge. For some, it will mean an expansion of personal knowledge through an external search of sources such as journals and real-world practice settings for relevant exemplars, types and rules. Others, confident in their personal knowledge and experience, will be content with search of the internal memory through their own cognitive stores of information. Either way, search begins the process of problem discovery. The designer must determine whether the knowledge stored in existing solutions is sufficient to solve the present problem. If it is not, he must determine whether adaptation of existing solutions will suffice or if more revolutionary innovation is required - or desirable. For disciplines like planning, where a range of alternatives is required, and a single brilliant solution will not suffice, the practitioner must further establish what mix of search and design will yield an acceptable range of solution. Fundamental to the inquiry must be the aim of betterment: even if search yields a number of satisfactory alternatives, is it not possible that conscious design will produce better ones? Practical evidence presented in this chapter suggests that problem solvers are generally content with search efforts that yield only one or two potential solutions. The role of design in generating alternatives is therefore relatively circumscribed. And while this may be preferable in terms of the manageability of the overall generation exercise, it may not be so for the quality of solution. After all, it is the demonstrated poor performance of solution-in-practice that has stimulated the recent concern with improving the generation of alternatives stage of the decision-making process. The role of design within the generation of alternatives must be evaluated in these terms. The difficulties that design presents for practice must be weighed and assessed according to any potential benefits it offers for improved solution. Effort must be expended to understand how the decision-making process can accommodate the complexities of design. The examination of design in this chapter makes it possible to begin such a determination, for planning, in Chapter 6.

NOTES

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1. See Taylor and Getzels (1975) for a summary of these different perspectives. They include such things as personality traits of creative people, creative products, creative process, creative environments, creativity and mental health, and creativity and intelligence.

2. As Arieti (1976) observes, it is necessary to distinguish what is specific to the creative process from what is common to all problem-solving efforts. Illumination is the distinguishing feature.

3. The reconstruction of information implies that something controls the process. According to Lawson (1980, p.98), it is the "executive" that is responsible for switching our attention from one part of the problem to another or allows us to reorganize our perceptions in new ways.

4. Planning is obviously a social process in another sense, with planners making decisions on behalf of and in the interest of society as a whole. This was a point of discussion in Chapter 2.

5. Protocol analysis is a research methodology which involves recording the behavior and verbalizations of a designer performing a specific task. A protocol is the recorded behavior of the problem-solver. Eckersley (1988) summarizes the use of protocol analysis to date, assessing cognitive processes in design. His caution about the method is noteworthy. There is no guarantee that the designer's verbalizations are accurate descriptions of what is actually occurring on a cognitive level. They may, in fact, bear little relation to what is actually occurring.

6. Schon and Porter conducted the studies jointly but reported the results individually.

7. This point applies equally well to the search aspect of generation activity.

CHAPTER 5

DESIGN METHODS
AND CHARACTERISTICS OF THE DESIGNER

5.0 Introduction

Chapter 4 described the nature of design and the design process. In particular, the design process was found to be methodologically and conceptually difficult, encompassing many different kinds of thought and knowledge. No magic, surefire formula for the perfect process exists. Rather, controlling and varying the design process in response to each problem is one of the fundamental challenges the designer must face. But the descriptions of design in Chapter 4 are incomplete as a basis for theory of design in the planning process. Applied disciplines, like planning, rely on theory to instruct their practitioners on methods and abilities that are central to their practice. In this vein, Chapter 5 addresses *design methods*, as the tools and strategies that might be brought to a design problem, and the *characteristics of the designer*, as the skills, talents and traits that determine their use. The two are treated in concert because design is a subjective process. If and when design methods are used and whether they will be effective in their purpose will depend on the personal qualities of the designer.

5.1 Methods

A "design method" is any action taken or strategy employed in translating a problem into solution. It may be as unstructured as asking a colleague's opinion or as rigorous as a step-wise algorithmic formula. Most commonly, the term is reserved for the group of methods exemplified by the latter type: step-by-step, learnable, repeatable and communicable procedures, specifically developed to aid the practitioner in his quest for effective solution (Grant, 1978). Jones (1981, p.62) sums up the purpose of design methods to the modern design process:

> A new problem is like an unknown land, of unknown extent, in which the explorer searches by making a network of journeys... Design methods are like the navigational tools and charts that he uses to plot the course of his journey so as to maintain some control over where he goes.

Methods enhance the designer's management of large, complex problems and highly interconnected systems (Jones, 1981; Grant, 1986; Crinnion, 1989; Whitfield and Warren, 1989). They lend organization and coherence to the design process and provide bases for externalizing and recording the designer's thought process (Jones, 1983; Kirk and Spreckelmeyer, 1988; Henderson and Falanga, 1989). They restrict the tendency for the designer to lock into a premature solution based on shoddy or incomplete analysis, and in many cases make the design process visible so that everyone can see what is being decided and why. As such, they expose underlying assumptions and value judgments. The design process thus becomes more conscious than would otherwise be the case (Tayefeh-Emamverdi, 1984). In addition, design methods can serve as a common reference point for team members in the analysis and exchange of design information. They facilitate collaboration and communication (Jones, 1983; Grant, 1986; Kirk and Spreckelmeyer, 1988). In sum, Grant (1978) describes design methods as "organized common sense". The underlying aims in their use are to make design problems more manageable, the process more explicit and solutions more effective.

5.1.1 Analyzing Problem Structure

Design methods have been developed to serve two basic purposes within the design process:

1. to define and analyze problem structure
2. to generate ideas

In the first sense, the aim is to guide exploration of the problem space so as to obtain an adequate problem definition. As such, methods that serve this purpose are equally relevant to the task of search, which also requires sufficient problem understanding to determine its appropriate direction. In fact, Chapter 4 established that an analysis of problem structure must underpin the entire generation process for wicked problems since only when the nature of the problem is properly understood is it possible to decide the respective roles of search and design within that process. The techniques related to problem definition and analysis can be further subdivided into those that aim to break a problem down into its major elements and identify any interrelationships between them and those that serve primarily to provide new problem perspectives (Van Gundy, 1981). The former are referred to as analytic techniques and the latter as redefinitional ones.

5.1.1.1 Analytic Techniques

Analytic techniques, above all else, are attempts to simplify the overwhelming complexity of large, interconnected systems. Typically, the methods address complexity by breaking a problem into its "logical parts" and solving each sub-problem separately. The successive resolutions of the sub-problems are then merged in the design of the overall solution (Akin, 1986; Rowe, 1987; Lang, 1987).

i. Alexander's Method

Alexander's (1963) method for dissecting problem structure was one of the first "analytic" methods proposed within the design methods movement. It has been used in the planning field to generate alternatives for structure plans in Britain (Booth and Jaffe, 1978; Bracken, 1981). The method makes explicit the manner in which the overall system and its component parts are to be identified. Typically the factors that influence a problem and the requirements of the design situation are identified as "nodes" in the overall problem structure. In Alexander's own example of finding the appropriate form for the joining of a group of residences to a city, one such node is "pedestrian access from automobile to dwelling, involving minimum possible distance and fatigue" (Jones, 1981, p.342). The relationships between requirements are depicted as links between nodes. A pair of nodes is said to be linked if "whatever you do about meeting one makes it harder or easier to meet the other, and if it is in the nature of the two requirements that they should be so connected, and not accidental" (Alexander, 1963, p.39). Once these interactions are identified, it becomes possible to separate the overall structure into sets that are "densely connected internally" and "loosely connected" to one another. Hence, the problem structure is said to emerge from the factors and their interrelationships, rather than from any preconceived notions of the designer (Bracken, 1981). Yet, at the same time, it must be clearly recognized that the designer initially defines which factors are considered relevant to the design situation. His ability in this respect is critical to the overall success of the method. It is essential that this be explicitly recognized and his assessment put to some form of critical analysis if the narrowness so derided by critics of "black box" designing is to be avoided.

It is also necessary to acknowledge Alexander's (1973; 1984) own criticism of the use of this and other design methods since it bears, indirectly, on the same point. In rejecting the wholesale retreat of designers into step-by-step, "sterile" procedures, he underscores the essential subjectivity of the design process; the need for the designer to be in the right frame of mind to tackle "the rather fearsome thing of creating a design" (Alexander, 1984). According to Alexander (1973, unpaged), "no one will become a better designer by blindly following this method or indeed by following any method blindly". It is only by achieving an understanding of the system of forces that make up the design situation and the deeper level of structure lying behind patterns that effective design becomes possible. Systematic methods such as Alexander's are but one element in the quest for this understanding. They do not replace the need for the designer's aesthetic sense, his appreciation of functional fit or the artistry embodied in knowing and reflecting-in-action. But they do lend logical structure to the investigation of problem and solution (Alexander, 1973). They bring assumptions and value judgments out into the open. An explicit picture is easier to criticize than a vague one. Design methods of this type represent a clear acknowledgment that there is a deep and important correspondence between the structure of a problem and the process of designing a physical form which answers that problem. According to Jones (1984), to use these methods, the designer needs to be able to identify important variables - the "right" ones - before he can mold structure to fit them. This stage is extremely difficult to do. It is subjective; it is intuitive.

ii. Strategic Choice

The strategic choice approach, considered briefly in Chapter 1, was intended for application to all areas of policy-making in local government (Friend and Hickling, 1987). It differs from Alexander's method in its articulation of explicit procedures and rules for the stages of evaluation and choice. It not only attempts to manage the complexity of planning situations by partitioning the overall problem into sub-problems of manageable size, it also confronts the uncertainty inherent in wicked problems generally, and planning problems specifically. With reference to the former, it employs the language and technique of analysis of interconnected decision areas (AIDA), which Jones (1981) calls one of the most powerful and reliable design methods developed so far. In essence, the approach is built around the recognition that decision makers must face four basic tradeoffs:

1. Simplification versus complexity - the extent to which a problem can be simplified without sacrificing the quality of solution.

2. Urgency versus lack of information - the need to make an immediate decision against the need for rigorous analysis.
3. Commitment versus flexibility - the need to balance commitment against leaving future options open.
4. Incrementality versus comprehensiveness (Hickling, 1975).

The one ingredient common to all four areas is uncertainty and the difficulties it presents. Strategic choice faces these problems by identifying the range of possible directions that could be taken, the uncertainties that make choice difficult, the actions that can be taken to manage uncertainty, and decisions that will leave flexibility and discretion for future planning while not sacrificing the present need for some action and commitment. The process is a cyclic one, with many successive shapings of the problem and alternatives as attempts are made to cope with the uncertainty and complexity inherent in the planning situation (Figure 6). Within the process, uncertainty is reduced as far as possible through the acquisition of additional information. The residual uncertainty is then "managed" by sensitivity in the evaluation of solutions, to the extent each one preserves future decision-making flexibility.

AIDA provides the tools for simplifying the complexity of the planning situation. The planning problem is structured by breaking the design situation into decision areas and displaying them symbolically in a strategy graph. The range of potential options is then identified and the relationships between decision areas and options are subject to critical analysis. Incompatible options are represented by lines drawn between them, called option bars. If an option bar might be lifted by a change in policy, the

Figure 6

The strategic choice approach

Source: Hickling 1975

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bar is depicted as a broken line. The option graph is then translated into a solution table which lists the range of feasible options. These solutions are evaluated in terms of the goals for the planning exercise and the basic principles of strategic choice, that uncertainty be explicitly recognized and that the flexibility of future decision be preserved, as far as possible. Within the procedure, it is permissible to simplify the problem and reduce complexity in much the same way as in Alexander's method. The strategy and option graphs can be "partitioned", according to the interconnectedness of decision areas. The new graphs, representing sub-problems of the overall problem, are then treated separately until the stage of overall solution, when the range of feasible solutions in each one is combined with the others for simultaneous consideration.

In terms of selecting which sub-problem to consider first, and thereby establishing an "initial focus", it is theorized that it really does not much matter where the analysis begins:

> Now, it does not really matter too much what the Initial Focus is, because using the cyclic process, if we get it wrong the first time, we just come back through and correct it. Recycling allows us to drop out the Decision Areas that are now irrelevant (putting aside), and to bring in the ones that are important (clustering together) (Hickling, 1975, p.26).

However, based on their assessment of the generation and evaluation stages in British structure planning, in cases where strategic choice was utilized, Booth and Jaffe (1978) suggest that the range of policy options was, in fact, altered by the nature of the definition of decision areas and the order in which they were handled. Moreover, they suggest that the type of value judgments these decisions represent "opens up the weakness of too great a dependence on explicit but informal judgment without adequate support by analysis" (Booth and Jaffe, 1978, p.452). This criticism is similar to the one leveled at Alexander's technique, and in fact could be applied against all design methods. To preserve the integrity of the design process, the methods must be applied with specific attention to rigor, and the value judgments and assumptions put to critical analysis at each stage where they are required.

5.1.1.2 Redefinitional Techniques

The next group of techniques, still aimed at exploring problem structure, focus on redefining existing or conventional frameworks of thought so that a new understanding of the problem might emerge. They do not contravene or replace the need for analytic techniques, but go hand in hand with them to achieve a well-rounded understanding of problem structure. The act of analyzing a problem will often contribute to a new definition or understanding of problem structure. Similarly, the redefinition of a problem will center on a well-grounded analysis of major problem components (Van Gundy, 1981). The two redefinitional methods considered here are aids in generating new frameworks of thought. As Stewart (1982, p.31) remarks, new alternatives need new stories which describe the boundaries of the problem space.

i. Reversals Method

The basic rule underlying this method is that for every well-defined direction of a problem there will be an opposite and equally well-defined other direction (Van Gundy, 1981, p.54). By reversing the direction of the problem in any way possible, a new definition or understanding of the problem might be achieved. Clearly not all reversals will produce fruitful or practical definitions. Van Gundy (1981, p.54) summarizes the approach for a university parking problem:

> As originally stated, the problem was: How to provide parking spaces for commuter students on an already over-crowded campus? Reversing the problem produces a new definition: How to provide commuter students for parking spaces? This definition led to the solution of developing parking lots on the outside edges of town. The commuter students would drive to these lots and then board buses that would take them directly to campus.

In reversing the direction of problem understanding, the designer might change the dominant assumptions underlying his framework of thought and reveal a new set of constraints and opportunities to act upon.

ii. Boundary Examinations

As observed earlier, when defining a problem structure, the designer subjectively sets boundaries on his investigation of critical factors involved in designing alternative solutions. In using the boundary examinations method, these boundaries are actively challenged. The designer presumes that all boundary definitions are based on a set of underlying assumptions which must be restructured if a new way of looking at a problem is to be achieved (De Bono, 1970; Van Gundy, 1981; Stewart, 1982).

Consider the following problem statement: To promote a sense of community within residential neighborhoods in urban areas. The boundaries of the problem can be examined by considering underlying assumptions about the concepts of community and neighborhood - most basically, whether the two need be related at all. Does sense of community derive from residential neighborhood affiliations or is it more broadly based, say in terms of communities of interest drawn from membership in occupational, professional, recreational or other organized groups? Is community a legitimate spatial concept at all? Should neighborhoods be viewed in any other sense than as districts for the efficient provision of urban services? All of these questions challenge assumptions implicit in the original problem statement. And while the boundary examination method lacks direction about how assumptions should be analyzed, it does seem to possess the potential to provoke conscious assessment of the bases for problem definition.

5.1.2 Idea Generation

The intent in this group of methods is to promote divergent thought deliberately and consciously, in the belief that the probability of hitting on effective solutions is higher in a longer than a shorter list of alternatives. In fact, there are those who argue that the capacity to generate many potential solutions is the hallmark of truly creative designers (Lang, 1987; Kirk and Spreckelmeyer, 1988; Dacey, 1989). This group of techniques is derived for use when obvious search space has been exhausted or when the designer is stymied by perceptual, habitual, emotional or professional roadblocks (Kirk and Spreckelmeyer, 1988).

5.1.2.1 Lateral Thinking

The concept of lateral thinking, as a way of circumventing conventional ways of reading a problem, is implicit in many of the methods suggested for stimulating divergent thought. As developed by De Bono (1968; 1970), it "is not so much a formal technique as it is a method for developing new attitudes to apply to the thinking process" (Van Gundy, 1981, p.234). New attitudes lead to new ideas. De Bono's approach rests on a distinction between lateral and vertical thought processes. Lateral thinking is concerned with changing concepts and perceptions through leaps of thought. Vertical thinking, on the other hand, is the rational and smooth progression of thought in a step-wise, linear manner:

> Just as water flows down slopes, settles in hollows and is confined to river beds, so vertical thinking flows along the most probable paths and by its very flow increases the probability of those paths for the future. If vertical thinking is high probability thinking, then lateral thinking is low probability thinking. New channels are deliberately cut to alter the flow of the water. The old channels are dammed up in the hope that the water will seek out and take to new and better patterns of flow (De Bono, 1968, p.16).

Vertical thinking is selective and analytical while lateral thinking is generative and provocative. Lateral thinking welcomes intrusions by "irrelevant information" (Dacey, 1989). It aims to change the perceptual process by which the designer orders the complex world into patterns and symbols. The major premise that underlies lateral thinking is that any method that will provide a different perspective is valid as long as the whole process remains firmly controlled: "If lateral thinking chooses to use chaos, it is chaos by direction, not chaos through the absence of direction" (De Bono, 1968, p.17).

5.1.2.2 Checklists

Checklisting is an example of a technique that establishes an orderly way of identifying and creating ideas and hence might facilitate lateral thinking (Kirk and Spreckelmeyer, 1988). Its appeal lies in its apparent simplicity. As the name of the technique suggests, the designer compiles lists to make sure all bases are covered in the search for new leads. Osborn (1963) provides the following example of a checklist:

1.	Adapt	What other product is like this one?
2.	Modify	How could I change this product?
3.	Magnify	What could I add?
4.	Minify	What could I take away?
5.	Substitute	What could I use instead?
6.	Rearrange	How could I alter the composition?
7.	Reversal	How could I turn this problem around?
8.	Combine	What could I put together to make something new?

Because they tend to restrict the designer's thought process to the items listed, checklists can obstruct lateral thought as much as aid it. Success seems to lie in the designer's ability to construct open-ended and diverse lists while recognizing their inherent limitations.

5.1.2.3 Morphological Analysis

Morphological analysis forces divergent thinking by requiring the designer to specify all of the important parameters on which the problem solution depends and the possible forms that each parameter might take (Jones, 1981; Kirk and Spreckelmeyer, 1988). These factors are recorded in the form of a matrix, which provides a ready graphic display of all the relationships inherent in the problem (Figure 7). The technique results in a high number of solutions, although many of them will be quickly eliminated due to inherent incompatibilities and conflicts. The discipline of their specification is, however, worthwhile: "In some cases we

Figure 7

Morphological method applied to a new town design

Source: Chadwick 1978

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shall find that certain combinations are inadmissible, but the questions are always worth asking as they may reveal hitherto unanticipated combinations which may prove very fruitful" (Chadwick, 1978, p.168).

Difficulties with morphological analysis are not unlike those presented for other methods. It requires a knowledge of problem structure, in both the identification of factors and the searching for acceptable combinations of sub-solutions, that the method itself does not expose. Its attractiveness is that it forces the designer to expand his area of search.

5.1.2.4 Brainstorming

Other methods for generating ideas draw more openly on the intuitive and subjective abilities of the designer. Brainstorming is a small-group procedure first developed by Osborn (1963) to stimulate generative discussion amongst individuals rather than critical debate and argumentation. Ideas are put forward with the aim of promoting variety rather than one, specific "best" solution. Judgment of alternatives is suspended in the hope that some truly useful suggestions will emerge from a vast number of possibilities. It is estimated that six people can produce about 150 ideas in half an hour, and many of these ideas will expose the designer to new ramifications and points of entry for the problem (Dacey, 1989). Brainstorming sessions are guided by four basic rules:

1. There can be no criticism of ideas.
2. "Freewheeling" is welcomed; wild, funny or even silly ideas are encouraged.
3. Quantity is emphasized.
4. Using other's contributions as springboards for further options is encouraged.

The brainstorming group itself should be selected to represent varied points of view and diverse backgrounds, although, ideally, all group members should have some knowledge or facility with the type of problem under consideration. In addition, group members should represent parallel levels of responsibility since the random mixing of superiors and subordinates might inhibit the free flow of ideas (Kirk and Spreckelmeyer, 1988).

Evaluations of the usefulness of brainstorming have been mixed. Some studies suggest that deferring judgment yields no better results than simply asking individuals or groups to come up with high quality ideas (Stein, 1975). The most damaging finding of all is that several individuals working in isolation can produce more ideas than a brainstorming group (Van Gundy, 1981). On the other hand, anecdotal accounts of the method endorse it wholeheartedly as a potent tool for facilitating group collaboration and bonding. Kirk and Spreckelmeyer (1988) illustrate how the technique was utilized to derive 25 solid design ideas for a large corporate headquarters. Osborn's (1963) own results are also encouraging. Given the controversy about brainstorming, Jones (1981, pp.275,276) suggested that it be viewed as a fast way to introduce the requisite variety with which the serious search for a solution can begin.

5.1.2.5 Delphi Approach

The delphi approach is a variant of brainstorming in that it, too, involves a number of participants and aims to stimulate variety. The chief point of difference is that it utilizes a formal questionnaire format to elicit responses and makes more conscious effort to involve only those individuals judged to possess high skill in the field under consideration (Henderson and Falanga, 1989). In fact, the essential feature of the method is its emphasis on expert consensus. The questionnaire process is repeated until consensus is achieved or a problem sufficiently answered (Van Gundy, 1981).

A major advantage of the delphi method over classical brainstorming is that it minimizes personality bias in achieving group consensus. In any verbal group discussion, the majority opinion might be a compromise rather than a true consensus, with the compromise revealing an over-representation of strong personality types (Kirk and Spreckelmeyer, 1988). At the same time, the delphi process is extremely time consuming and requires a high level of participant skill and motivation. Furthermore, participants have no opportunity to "piggyback" or build upon the ideas of others in the process (Van Gundy, 1981). Nonetheless, Kirk and Spreckelmeyer (1988, p.230) document admirable results in utilizing the delphi method for the design of a data processing center:

> In a number of Delphi sessions, the team created a range of system alternatives and design options. The original project goals guided the team to focus on cost control, system flexibility, and design quality... The team identified more than one hundred ideas during the Delphi session...

These ideas were then used as a basis for the assembly of a refined group of alternatives for further consideration. In Jones's (1981) terms, they became the requisite variety upon which to base serious design effort.

5.1.2.6 Synectics

The synectic approach involves the free use of metaphor and analogy to stimulate "making the strange familiar and the familiar strange" (Gordon, 1961). Carefully selected groups of individuals are brought together to explore problems via four types of analogy (Jones, 1981; Van Gundy, 1981; Kirk and Spreckelmeyer, 1988; Dacey, 1989):

1. Personal analogy - personal identification with the elements of a problem.
2. Direct analogy - a clear and straightforward relationship between the problem and some other object, idea or thing (e.g. door hinge and clam shell).
3. Symbolic analogy - objective and impersonal images to describe the problem (e.g. poetic metaphors and similes).
4. Fantasy analogy - conscious, unrestrained imagination to explore a situation (e.g. we need a slave to dial the telephone).

These analogies are used to transform the problem into terms that are familiar to the members of the team in the hope that a solution will emerge. Dacey (1989) describes one example where the results endorse the success of the approach. Participants were asked to find a solution to the problem of disposing of crushed glass from compacted automobiles:

> Earlier efforts by other groups, which were asked to deal directly with the glass problems, only produced costly solutions like dumping it in the ocean. The synectics group... was told of the broken glass problem and asked to think of uses for it. Here direct analogy came in. Someone said that the crushed glass reminded him of crystals of sugar. He suggested that as with cotton candy, the glass could be melted and, through centrifugal force, sprayed against the inner walls of a spinning cylinder to produce sheets of spun glass (Dacey, 1989, p.127).

Fiberglas, the resulting invention, has introduced revolutionary changes in the construction world.

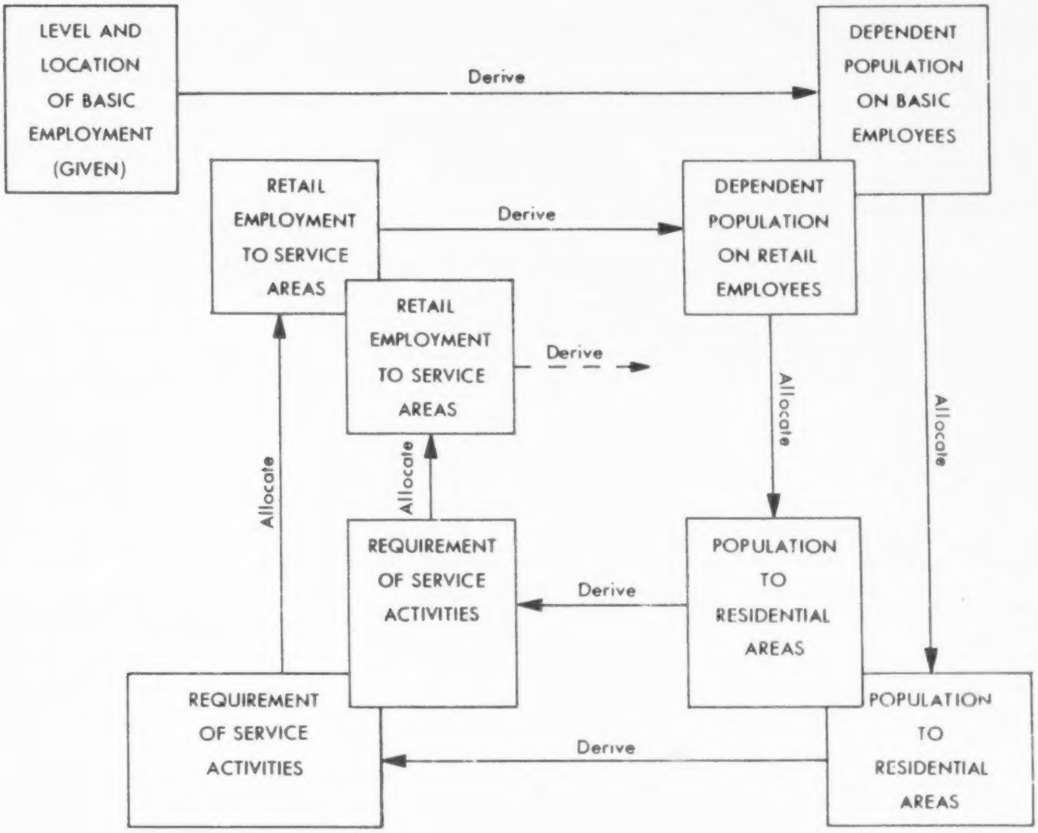
5.1.3 Quantitative Modeling

Another method - or perhaps more correctly, group of methods - which merits substantial attention is mathematical modeling of cities and regions undertaken specifically to foster an understanding of complex urban processes and systems. As noted in Chapter 1, computer-based models commanded an impressive following in planning literature of the 1960s and 1970s, where theorists and practitioners alike were eager to expose their potential benefits for every stage of the planning process, including plan generation. Though attention has been more circumscribed in the 1980s and 1990s (thus far), and large-scale mathematical models have been largely discarded by practicing professionals, a die-hard group continues to investigate their application to urban planning problems. Some of the recent efforts remain mired in esoteric questions of mathematical and computational rigor (Batty, 1986; Colorni, 1987), but others have been fueled by the aim of improving the realism of the models (Allen, Engelen and Sanglier, 1986; De Palma and Lefevre, 1987), or of enhancing our understanding of their proper role in the planning process (Oppenheim, 1986; Simmonds, 1986; Ortolano and Perman, 1990). During the first two decades of model development, it was assumed by many planners that quantitative models would be the ultimate tool for plan generation - that once the urban system could be plausibly reproduced in model form it was but a short step to forecasting and prediction and on to prescription. It is in this view that quantitative modeling is discussed here. By exploring misconceptions and failings of initial modeling attempts and the criticisms they engendered, it is possible to posit a more realistic purpose and set of requirements for them in future planning endeavors.

At the outset, it must be emphasized that the principal focus is on large-scale, comprehensive attempts to model entire urban or regional systems, although some consideration is given to optimization models such as public facility location-allocation schemes. In terms of the framework outlined in section 5.1.1 of this chapter, it was never entirely clear from planning literature whether these models were intended primarily as aids in structuring design problems, as generators of potential solutions, or some combination thereof. As such, quantitative modeling is treated separately here.

According to Bracken (1981), much of the impetus to the development of urban models came during the period from 1968 to 1974, when they were thought of as vital aids in planning at both the regional/metropolitan scale and the city/town scale. Models concerned with the regional/metropolitan scale - called "activity-allocation" models - were amply demonstrated by a number of empirical studies related to the preparation of structure plans in Britain and metropolitan plans in the United States (Hill, 1965; Garin, 1966; Cripps and Foot, 1969; Lee, 1973; Batty, 1978). In fact, this type of model dominated both practical and theoretical attention of the day. Models concerned with the town/city scale - called "stocks-activities" models - received far less practical application, although they did figure prominently in studies pertaining to the development of the British new towns of Milton Keynes and Stevenage (Echenique, Crowther and Lindsay, 1969), and preliminary studies for Cleveland in the United States (Barras, 1975). Both groups of models have as their foundation the Lowry model of metropolis which is generally regarded as the point of departure for the entire urban systems modeling movement (King, 1969; Lee, 1973; Oppenheim, 1986). It continues to exert influence, even today. As such, it is worth describing here, at least in general terms.

The Lowry model, named after its inventor Ira Lowry, was begun as part of the economic study of the Pittsburgh region undertaken by the Pittsburgh Regional Planning Association in 1962-63. It was completed as part of a larger urban transportation study at the Rand Corporation in 1964 (Lowry, 1964). Intended for broad-brush planning at the regional/metropolitan scale, the model builds an "instant metropolis" from scratch, using an iterative procedure to forecast the spatial distribution of population and employment given an exogenously determined level of basic employment (i.e. employment in export industries which are relatively unconstrained in local site selection by problems of access to local markets). The model consists of nine mathematical equations which first generate retail employment and number of households in the city using an economic base mechanism. These totals are then allocated among the subregions of the metropolis using potential accessibility models.[1] Generation and allocation processes are related in the following manner (Figure 8). The population of a region is a function of available employment, in both basic and service/retail sectors. The initial trigger for the model is a level of basic employment, located "by hand", which then deter-


LEVEL AND LOCATION OF BASIC EMPLOYMENT (GIVEN)
Derive
DEPENDENT POPULATION ON BASIC EMPLOYEES
RETAIL EMPLOYMENT TO SERVICE AREAS
Derive
DEPENDENT POPULATION ON RETAIL EMPLOYEES
RETAIL EMPLOYMENT TO SERVICE AREAS
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Allocate
REQUIREMENT OF SERVICE ACTIVITIES
Derive
POPULATION TO RESIDENTIAL AREAS
REQUIREMENT OF SERVICE ACTIVITIES
Derive
POPULATION TO RESIDENTIAL AREAS

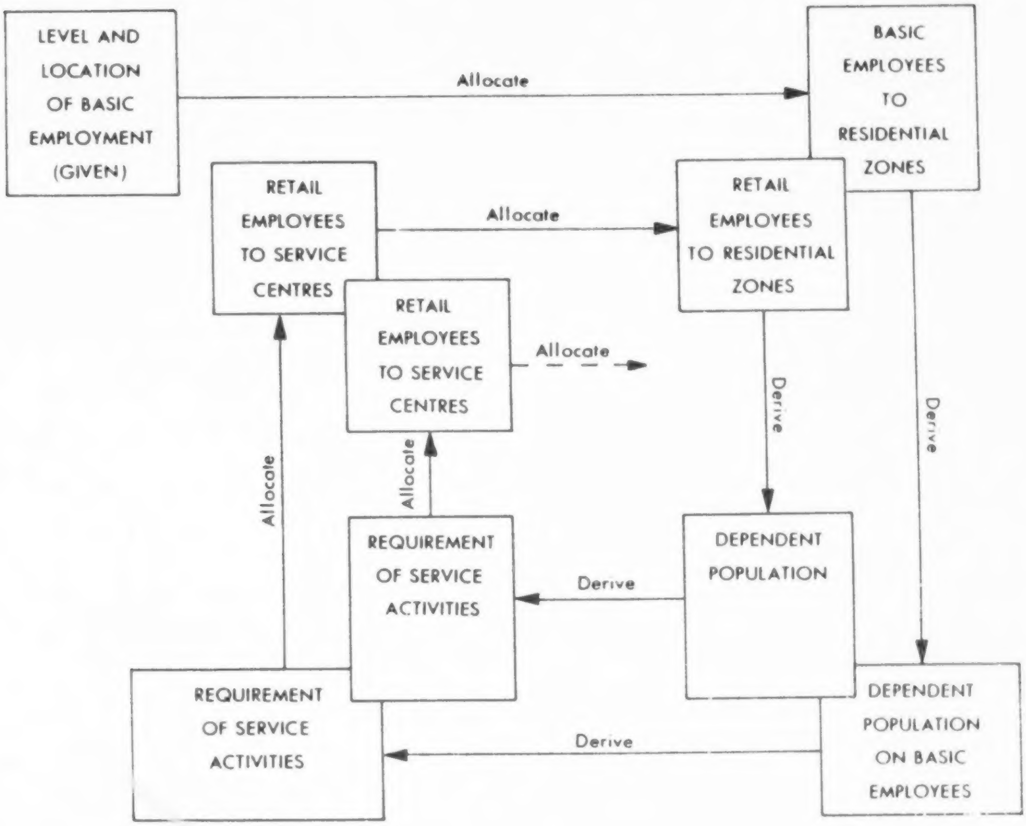
Source: Adapted from Reif, 1973

Figure 8: Functional structure of the Lowry model

mines the subsequent location of households and retail activities. It is presumed that the location of basic employment is independent of the location patterns of other activities (i.e. retail employment and population) but that these other activities are locationally dependent upon basic employment. This means that the pattern of residential location is wholly influenced by the location of basic employment opportunities. The location of services does not affect the place of residence because retail stores appear only in response to residential development. The model continues, with exogenous pulses of basic employment stimulating population and retail growth, until the system reaches an equilibrium state (Lowry, 1964; King, 1969; Reif, 1973; Lee, 1973; Batty 1978).

More recent versions of the model (and most practical applications) follow Garin (1966) in making use of gravity models, rather than potential models, to allocate population. In addition, Garin's method generates increments of activity and immediately allocates it to zones, operating in a sequential linear fashion, rather than generating all activity first and then allocating it to zones as Lowry did (Figure 9).

Overall, the Lowry model and its successors were intended to be used to project future patterns of land development and to test the effects of different policies in land use and transportation planning areas (Lowry, 1964). According to Lowry, they were not intended as normative or "planning" models. This point is significant. Forecasting or predictive models tell us what is likely to happen on the basis of certain assumptions. Their role in the


LEVEL AND LOCATION OF BASIC EMPLOYMENT (GIVEN)
Allocate
BASIC EMPLOYEES TO RESIDENTIAL ZONES
RETAIL EMPLOYEES TO SERVICE CENTRES
Allocate
RETAIL EMPLOYEES TO RESIDENTIAL ZONES
RETAIL EMPLOYEES TO SERVICE CENTRES
Allocate
Derive
Derive
Allocate
Allocate
REQUIREMENT OF SERVICE ACTIVITIES
Derive
DEPENDENT POPULATION
REQUIREMENT OF SERVICE ACTIVITIES
Derive
DEPENDENT POPULATION ON BASIC EMPLOYEES

Source: Adapted from Reif, 1973

Figure 9: Functional structure of the Garin-Lowry model

planning process is to provide a starting point for generation attempts, by yielding a range of solutions that can be compared in relative or "what if" terms. These solutions need not be "correct" in terms of reality but are conditional predictions based on limited sets of assumptions.

Normative models, on the other hand, identify desirable or "best" courses of events on the basis of built-in goals, objectives and constraints stated in mathematical terms. They are, in Wilson's (1986) terms, optimization frameworks. Location-allocation models which jointly select a set of facility locations and allocate service areas to them on the basis of some optimizing objective function (generally the maximization of accessibility through the minimization of distance traveled) serve as case-in-point (Scott, 1970; Lee, 1973; White, 1979; Hodgson and Bayne, 1990).

Early in the urban modeling movement it was widely assumed that Lowry-type models and optimization formulations would provide the ultimate answer to the plan generation problem by permitting the simultaneous generation and evaluation of large numbers of solutions, objectively and rapidly. These assumptions were overblown, as is evidenced by the veritable deluge of criticism that urban models have suffered over the last thirty years. As Breheny and Foot (1986) note, this criticism is an outgrowth of a wider disenchantment with the scientific-comprehensive approach to planning and with quantification in the social sciences more generally.

Much of the criticism of urban modeling centers on the difficulty in deriving accurate representations of real-world conditions. Models are, by definition, simplifications of reality. Yet, as Sayer (1976) points out, with simplification comes the risk of distorting and obscuring the very facets of reality that are critical to effective decision making. This vein of criticism emphasizes the basic requirements of any models that are to be useful for planning purposes. First and foremost, they should be capable of representing the major variables of the urban system and of producing output related to the planner's needs (Simmonds, 1986). They must address themselves to real-problem situations, taking at least basic account of the social, political and psychological context in which decisions are made (Bolan, 1970). This is what most urban modeling efforts fail to do (King, 1969; Hemmens, 1970).

Sayer's (1976) critique of Lowry's model suggests that the theory underpinning urban models is at best inadequate and at worst misleading:

> Implicit in our critique is the view that the all-absorbing preoccupation with mathematical form which typifies so much of regional science is symptomatic of an inadequate and highly inhibiting conception of the nature of society... The view that the social sciences can be made truly scientific or hard by mimicking physics or by mere application of rigorous mathematical techniques is popular but misconceived, for it fails to specify a particular ontology (theory of what exists)... The danger of this inhibiting epistemology is that it sweeps all the problems of developing theories of society under the carpet; the fundamental questions of what aspect of social reality we should examine and how we should go about the process of abstraction are considered unproblematic. The lack of theoretical content in the mathematical models would seem to imply either an ignorance of so-

> cial theory or dismissal of the latter as unscientific (Sayer, 1976, pp.192).

In equally harsh terms, Bolan (1970) suggests that Lowry-type models do nothing more than help us understand the workings of the real estate market and what might happen "if we tinker with it a bit". For the crucial problems of planning - how to make better cities and substantively improve the welfare of society - they offer no insight.

In a similar vein, urban models are often criticized for their simplistic assumptions about the behavior of individuals. Decision makers are presumed to be perfectly rational, to possess complete and accurate information, and to have unerring foresight (King, 1969; Reif, 1973; Sayer, 1976; Oppenheim, 1986). In optimization models, behavior considerations are often subsumed within simple objective functions whose form is dictated more by considerations of computational tractability than by realistic psychological, sociological or economic behavior theories (Lerman, 1985). In sum, urban models to date have been inadequate in representing important variables in the urban system.

More recently, there have been attempts to redress these shortcomings. Numerous modelers have attempted to make models dynamic rather than static (Wilson, 1981; 1987; Clarke and Wilson, 1983; Allen, Engelen and Sanglier, 1986), and many others have directed attention to improving their behavioral content (Roy and Vinckle, 1981; Anas, 1983; Lerman, 1985; 1986; Nijkamp, 1986). Still, these advances do little to enhance the attractiveness of the models for practical application. Certainly, the new and improved formulations are more powerful, more sophisticated and more realistic than those that preceded them. But they are also more complex and more esoteric, making them of limited value to the rank-and-file practitioner unskilled in the wizardry of mathematical formulation (Oppenheim, 1986). This means that the development of urban models has been conducted largely independent of user needs and applications. It is unreasonable to expect planners to utilize techniques that are beyond their comprehension; to lay faith in models that they cannot legitimately assess or stand behind because they simply cannot figure them out. At the very least, planners must be able to understand the tools at their disposal, and so operate them without the necessary technical processes consuming their whole attention at the expense of the overall planning problem (Hemmens, 1970; Alderson, 1970; Simmonds, 1986).

Even before their recent sophistication, urban models were stalled in real-world application. In a 1969 study, Alderson (1970) observed that few American planning agencies had the necessary technical skill to utilize these rather specialized techniques. Nor could they afford the financial commitment to ensure that skills were acquired (Hemmens, 1970). In fact, even planning agencies that were competent to develop and run the models were hesitant to use them in practice. In 1968, the Southeast Wisconsin Regional Planning Commission developed some of the most advanced mathematical formulations of the time yet still derived their long-range regional plan by conventional non-analytic methods (King, 1969). This underscores the limited practical utility of most large-scale modeling efforts. As Simmonds (1986) points out, modelers should not try to elaborate from simple, explorative models in the hope of creating powerful predictive and prescriptive tools.

The complexity of model formulations is not the only practical problem. Equally pressing are a number of data problems related to operationalizing models which are, for the most part, "data hungry" (Chapin and Kaiser, 1985). Information is rarely available in a form suited to modeling purposes, and elaborate, time-consuming and costly collection excursions are frequently required (Lee, 1973). In one study, only 7 percent of the 135 planning agencies surveyed had the necessary data to implement large-scale modeling efforts (Carlson, 1968). Even Lowry, when operationalizing his model for the Pittsburgh study, had to downgrade his requirements to allow for the highly aggregated nature of the data available to him (Hemmens, 1970). Very often, data are not available in spatial subunits that are suitable for a model's effective operation (Reif, 1973; Hodgson and Bayne, 1990). And as models have become more sophisticated, these problems have been compounded - more data collection, increased computing time and a longer period required to perform the analysis (Foot, 1981; Breheny and Foot, 1986).

In terms of plan generation, the most damning criticism relates to the distinction that must be made between positive and prescriptive models (Batty, 1978; Bracken, 1981). Urban system models are positive. They are based on descriptions of existing reality and they make predictive statements on the basis of these descriptions. Plan generation, on the other hand, is a normative activity concerned with devising better cities. Positive models are inadequate to this task (Batty, 1978). Yet, as Bolan (1970, p.80) notes, they became, at least in some minds, a substitute for normative direction. The consequences for planning are grave:

> Such techniques... have unobtrusively moved from providing *knowledge* to providing prescription so that the bold utopias of the planner emerge from a computer print-out... The general result of this shift has been some of the most spectacular conservative defenses of the status quo to gladden the heart of any avowed reactionary. These are multi-million dollar planning methods and they do little more than tell us that the future ought to be pretty much the same as the past... Today's planner, for all his 'comprehensiveness', is really little more than a timid incrementalist: The techniques do nothing more than finely tune the parameters of the past. When this becomes the basis for prescribing the future - that distant utopia - it's not too hard to imagine what the prescription will be.

Urban system models do have a role to play in plan generation. As evidenced in Chapter 4 of this thesis, a part of the generation task centers on analysis; it is partly a learning experience in which the planner comes to grips with the reality of his context. He cannot plot a course from where the city is to where it should be unless he understands the present. Models can enhance this understanding, but they are no substitute for the intensely subjective interpretations and judgments that must be made, or for the imaginative sense of the planner in uncovering new possibilities. Even if normative models could be devised - and optimization programs such as location-allocation models are an attempt in this direction - it is doubtful, given the practical considerations outlined above, that they could ever come close to incorporating the intricate political and social realities that affect planning decisions (Batty, 1978). Much pointed criticism has been directed at the simplistic objective functions and weighting schemes employed in trying to introduce concepts such as equity (Dear, 1974; 1978; Morrill, 1974; White, 1979; Lucy, 1981). The larger question is whether or not the relationships of formal mathematical logic can ever realistically represent all of the facets involved in making prescriptive statements. Critics of urban models suggest not.

On balance, it would seem that the most appropriate role for urban systems models is in the analytic phases of planmaking. Models can be used to uncover realities that are logically possible given very constrained conditions and assumptions. They can also be used to discover the differential implications of the various land use and transportation arrangements represented in alternative solutions (Breheny and Foot, 1986; Hodgson and Bayne, 1990; Kim, Wiggins and Wright, 1990). Modeling then, as it relates to plan generation, is primarily a tool for developing insights into complex urban processes (Bracken, 1981). Like many of the methods described in the other sections of this chapter, quantitative models lend structure to the generation process. Their use, overall, has contributed to the explicit recognition of some of the factors affecting urban spatial structure. Moreover, the criticisms of their use have forced planners to address many aspects of the urban system that they had previously ignored. As they relate to plan generation, quantitative models are best regarded as tools for exploring the problem space.

5.1.4 Methods and the Designer

Design methods are but tools to assist the designer in making his decisions. They cannot be considered a panacea or antidote for the intensely personal judgments and decisions required from the designer throughout the difficult and value-laden design process. Without exception, they require him to exercise subjective judgment in their use - they incorporate some stage "which is extremely hard to do and which has no description of how to do it" (Jones, 1984, p.331). As Alexander (1984) so aptly points out, the real difficulties of design are not of the computable sort, solvable in some quantitative equation. Quality in design is directly related to the depth of the designer's insights. He must define key variables and interrelationships, impose values and priorities, and set bounds for the problem frame. It is perhaps understandable that this rather awesome responsibility might send him scurrying to find a blueprint for effective design. Yet, the desire to achieve quality, to represent the true nature of this multifaceted process, must focus attention elsewhere. The key to effective design lies in the art of knowing-in-action, as that which determines appropriate selection of methods and procedures and permits subjective judgments to be exercised wisely. Here then, we shift from an examination of design methods (which are still important for reasons cited earlier) to an investigation of the designer himself, and his facility and skill in performing design tasks.

5.2 The Designer as Agent in the Design Process

Chapter 4 established the designer as an agent in the design process. Her cognitive, attitudinal and personality traits bear directly on its shape and effectiveness and determine selection of tools and strategies within it. The bottom line is that the designer must possess abilities appropriate to the nature of design activity. The question is how to ensure she has them.

5.2.1 Key Characteristics and Abilities

> One of the characteristics of these people is that they are very open to all kinds of experience, particularly influences relevant to their design problem. Their awareness is high. They are sensitive to nuances in their internal and external environments. They are ready, in many ways, to notice particular coincidences in the rhythm of events which other people, because they are less aware and less open to their experience, fail to notice (Davies and Talbot, 1987, p.23)

In general terms, two basic types of characteristics have been highlighted for their role in creative problem solving:

1. Personality traits.
2. Intellectual or cognitive characteristics.

The former deals with the behavioral and emotional characteristics, attitudes and habits that relate to an individual's decisions and actions. The latter concentrates on those cognitive elements that affect the capacity for design knowledge and thought.

5.2.1.1 Personality Traits

In terms of personality traits, creative designers are said to be determined, independent, self-confident, ambitious, withdrawn, curious, imaginative and unconventional (Strzalecki, 1981; 1990). They are more likely to question the status quo, engage more frequently in solitary activities, like to do their own planning and make their own decisions, are optimistic, stubborn in the face of criticism and more emotional than most (Dacey, 1989). They are likely to be open-minded and oriented to purpose (MacKinnon, 1978; Nadler, 1989). In addition, creative individuals have been found to be self-centered, moody, nervous, obstinate and inconsiderate (Barron, 1965). High creatives appear to be strongly interested in aesthetic and theoretical matters, open to new experience, self-accepting and strongly motivated to achieve in situations requiring independent thought and action. They are also preoccupied, versatile, individualistic and complicated (MacKinnon, 1975).

What is not clear from research into personality traits is whether these traits foster creativity or are the result of the individual's creative disposition. It must suffice, at this point, to acknowledge that they are, somehow, affiliated with creative response. To go any further, on the basis of available evidence, would be foolhardy.

5.2.1.2 Intellectual and Cognitive Characteristics

The relationship between intellectual and cognitive characteristics and creativity is much clearer than the one between creativity and personality. Empirical evidence supports a claim that certain intellectual and cognitive abilities foster creativity (Guilford, 1975; Arieti, 1976). Moreover, some of these abilities can be taught, or at least enhanced (Dacey, 1989).

Before discussing the role of instruction in creativity, it is necessary to establish the nature of the relevant intellectual traits. Jackson and Messick's (1965) model identifies four categories of intellectual abilities associated with high creativity. The model also identifies the personality traits associated with each one:

Intellectual	Personality
1. Tolerance of ambiguity	Original
2. Analysis and intuition	Sensitive
3. Open-mindedness	Flexible
4. Reflection and spontaneity	Poetic

The first intellectual characteristic, which Dacey (1989) calls the most crucial aspect of the creative mind, refers to the capacity for facing the unknown and unfamiliar with little fear. It relates to a person's ability to cope in situations where there is no fixed framework to guide decisions and actions. Facts are missing and rules are unclear. While some individuals react with extreme anxiety and the urge to withdraw, others remain open to the new challenges and opportunities in the situation and are thereby able to impose an order of their own (MacKinnon, 1978; Dacey, 1989). According to Jackson and Messick's categorization, individuals who are tolerant of ambiguity are likely to exhibit originality in their personal and emotional habits.

The second intellectual characteristic, analysis and intuition, emphasizes the use of both left and right brain processes in creative thought. The leaps of imagination that result in innovation are born of subconscious processes that are usually considered intuitive. At the same time, it is the designer's analytic abilities in problem finding and in evaluating solutions against requirements that ensure a product is correct. To be creative, a design must be both innovative and appropriate. The type of person likely to produce such a design is sensitive:

> Such individuals seem to have special antennae the rest of us lack. They appear to have a sixth sense that allows them to delve into the heart of the situation and to be aware of the existence of problems before anyone else (Dacey, 1989, p.10).

It is the particular blend of analytic and synthetic abilities, linked to heightened perceptual awareness, that results in effective innovation. Right brain and left brain abilities are both strong and in balance.

The third intellectual ability, open-mindedness, refers to the designer's ability to receive new information without prejudice. Open-minded people are ready and willing to incorporate strange and unfamiliar information into their overall interpretive schemes. Just as they have a high tolerance for ambiguity, they view the unusual as a challenge rather than a threat, and are thus likely to come to new and insightful understandings (Dacey, 1989). Such open-mindedness arises from flexible personalities that are less rigid and less anxious than most (Jackson and Messick, 1965).

The final characteristic, reflection and spontaneity, is similar to the second in that it combines two seemingly contradictory styles of thought. Reflection refers to a slow, cautious approach to problem solving and spontaneity to a rapid, risk-taking "leap of faith" (Dacey, 1989). Nigel Cross (1983, p.41) similarly distinguishes between impulsive and reflective learning styles:

> 'Impulsive' children tend to report the first answer that occurs to them and this response is often incorrect. In contrast, 'reflective' children delay a

> rather long time before offering a solution to problem and this solution is often correct.

Citing research findings by Kagan (1965), Cross further notes that reflective individuals consider the relative strengths of alternative answers, persist longer with difficult tasks and strive to avoid errors. Impulsives propose decisions rapidly and tend not to worry about mistakes. But while on the surface it would appear that reflection is a more desirable trait than spontaneity, the creative mind must use both at appropriate times. Spontaneity prevents the designer from spending a lifetime in search and analysis. It grants courage to propose tentative solutions. At the same time, reflection ensures that the solutions bear some relationship to the problem at hand. The poetic person, able to switch back and forth between these cognitive styles at will, is most likely to possess the two abilities, in balance.

Dacey (1989) focuses on one of Jackson and Messick's four intellectual abilities - tolerance of ambiguity - as the most crucial aspect of the creative mind. He isolates seven personal and cognitive characteristics that contribute to this trait:

1. Stimulus freedom - the freedom to bend rules in a situation where necessary and to avoid assuming rules exist where none are stated.
2. Functional freedom - the ability to imagine many varied uses for an object usually seen as having one purpose.
3. Flexibility - the capacity to see the whole situation, without being fixated on only one part.
4. Risk taking - the ability to take moderate, reasonable risk.
5. Preference for disorder - disorder, as mirrored in complexity and asymmetry, is ultimately more interesting than order.
6. Delay of gratification - willingness to endure prolonged effort to achieve anticipated great benefit.

7. Adrogyny - persons who have higher than average male *and* female elements in their personality are androgynous.

In Dacey's scheme we move beyond the rather broad categorizations in models like Jackson and Messick's to particular abilities and traits that might be measured and explored more fully for the purposes of educating future designers. We leave behind tautologous statements, such as "the creative designer must have a creative personality", and gain explicit understandings of the abilities that are involved in analytic and synthetic thought.

In a similar vein, one other approach, which owes much to early work by Guilford (1957), merits mention for its effort to distinguish between divergent and convergent abilities. It stresses the importance of three factors to divergent thought production: fluency, flexibility and originality. Fluency of thinking is the designer's ability to produce a large number of ideas; flexibility his facility in producing varied ideas; and originality his capacity for uncommon or innovative response (Arieti, 1976). Summarizing from a number of sources (Taylor, 1964; Guilford, 1975; Arieti, 1976; Strzalecki, 1981; 1990; Lang, 1987), several different elements contribute to divergent thought production:

Divergence

* Figural fluency - the ability to generate many visual images.
* Ideational fluency - the ability to generate many semantic ideas.
* Spontaneous flexibility - the ability to produce a large variety of ideas in unconstrained situations.
* Adaptive flexibility - the ability to generate a variety of ideas in situations of less freedom (i.e. solution of a specific problem).
* Originality - the ability to generate unusual, ingenious solutions.

- Generalized sensitivity to problems - the ability to discern hidden problems.

In terms of the information processing model discussed in Chapter 4, these basic abilities shape the designer's capacity for receiving, manipulating and patterning incoming information in relevant ways.

Guilford's framework also distinguishes between visual and verbal thought capacities. Verbal skill refers to the designer's facility with semantic units in the form of verbal codes and languages. It is "imageless" thought (Guilford, 1975). Visual skill, on the other hand, relates to the individual's facility with figural units, or thought in the form of images and graphic patterns (Cross, 1981; John-Steiner, 1985; Muller, 1989). It is of obvious and particular importance to disciplines like architecture and land use planning, and it is said to be particularly attuned to design, or creative thought, because of the flexibility and fluidity inherent in visual images:

> There is no dictionary of images, or thesaurus of photographs and paintings...
> The absence of a single visual language may assist in the discovery process. Images come rapidly and are changeable - and it is difficult to externalize them fully. However, those very attributes contribute to their effectiveness in the exploratory and playful combination of ideas. In contrast, words may fix a notion (John-Steiner, 1985, p.86)

While words resist attempts to qualify or soften, visual thought is "ready-made for a myriad of nuances" (John-Steiner, 1985). And since evidence suggests that visual thought occurs in the right hemisphere of the brain, its nonverbal center, efforts to gain access to images must rely on corresponding right brain externalization techniques (Tovey, 1984; Cross, A., 1986). For disciplines like planning and architecture, drawing, diagramming and modeling become the external processes that make visual images available to conscious attention and focusing (Cross, A., 1986; Muller, 1989). They become the descriptive languages for image-based thought. Hence, the designer in these disciplines must have facility for both visuo-spatial thought and the rendering of three-dimensional representations. Yet drawing, without the corresponding visual insight, is a barren skill in design.

One other cognitive ability - intuition - warrants attention because of its prominence in nearly all discussion of design reasoning, albeit in vague and enigmatic terms. Intuition is a very rapid but logical processing of information in the unconscious mind (Agor, 1986; MacKay, 1989). It results in immediate apprehension or understanding of a situation. According to Agor (1986), it depends on a capacity to integrate a wide array of information on many levels, coming from both the left and right sides of the brain. It results from complex judgments that probably cannot be dissected, itemized or expressed verbally, yet draw on a "vast storehouse of unconscious knowledge" that includes everything one has ever learned or experienced, either subconsciously or subliminally (Vaughan, 1979, p.4). Intuition is positively related, then, to a person's education and experience in a particular subject matter. It can be used both to *explore* problem situation, yielding problem frames or directions for analysis, or to *synthesize*, allowing the integration of vast amounts of information in the production of possible solutions. Schon's (1983;

1987) description of knowing and reflecting-in-action embodies intuition in both of these ways and gives substance to its role in the design process: "The knowing is in the action. We reveal it by our *spontaneous*, skillful execution of the performance and we are characteristically unable to make it verbally explicit (Schon, 1987, p.25, emphasis added). Schon (1987, p.158) also links this intuitive, tacit process to the designer's aesthetic and functional sense: "Skillful designing depends on a designer's ability to recognize and appreciate desirable or undesirable design qualities". In fact, for disciplines like planning and architecture, it is not much of an exaggeration to say that such sense is absolutely indispensable. But can this sense be learned or nurtured, or is it more the prerogative of genetics - an innate talent? And what implications does the answer to this question have for design education and, more generally, design knowledge?

5.2.2 Talent Versus Skill

The nature versus nurture question applies with equal force to all of the characteristics of the designer discussed in this chapter. The answer is important to design education and practice for two reasons. First, if desirable characteristics can be learned, and hence presumably taught, design professions must first establish effective teaching methods and then tailor educational and practical settings to promote the operation of these skills. While not all individuals learn in the same manner (Cross, 1983; Portillo and Dohr, 1989), a broad range of teaching approaches could be designed to meet the needs of different learning types. Even given the challenge of different learning styles, the pool of prospective designers, and hence the opportunity for creative advance, is certainly greater if one believes creativity to be largely a matter of skill, rather than talent. To clarify, skill refers to one's capability to utilize knowledge effectively. It is a learned aptitude or ability as distinct from talent, which relates to natural endowments or capacities for learning. Genius, a special form of talent, distinguishes those individuals with transcendent mental superiority (Arieti, 1986). These distinctions are important for subsequent discussion.

The second reason the nature versus nurture debate is important relates to the planner's (or architect's or engineer's) capacity for controlling a problem-solving process. If design capabilities cannot be enhanced or taught, the design process rests rather precariously on intervention by fate, "the mystery of talent that falls capriciously, like divine grace, now on one individual, now on another" (Schon, 1987, p.10). In any event, the weight of measured opinion suggests that the nature/nurture question is not an either/or issue. Rather, creativity seems to be a blend of personality, talent *and* skill (Barron, 1969; Arieti, 1976; De Bono, 1985; Dacey, 1989). Given an individual with some creative predisposition, that person's talent can be enhanced by deliberate and systematic skill development. That is, while the capacity for creativity may be innate, the achievement of that capacity may be a subject for motivation and enhancement. Even with nurturing, however, not everyone will achieve the same success: "Some people will still be better at it, just as some are better at skiing or tennis - but most of us can reach a competence level. We are not all going to be geniuses but not every tennis player will win at Wimbledon" (De Bono, 1985, p.161).

In fact, very few tennis players will ever have the chance to play at Wimbledon, just as very few designers will ever have the opportunity (or latitude) to produce truly remarkable innovation. But this type of de novo design may not be needed very often. The important point is to equip designers for the rigors and demands of ordinary practice, facilitating skill development in those areas where skill plays a role. It may be that great innovation will have to await the genius mind and that the world will have to plod along within the existing framework until genius strikes. In this respect, the situation facing the practicing planner is not different from that facing, say, the physician awaiting a cure for AIDS or the automotive technician awaiting alternative fuels. He applies his knowledge to the utmost of his capabilities, identifying and selecting the best alternatives available to him at the time but not grinding the process to a halt while he waits for a miracle to strike. It is the duty of theory to provide him with the knowledge and skill necessary to perform this role; to provide a disciplinary framework that ensures its members have requisite abilities, be they talents or skills, and that these abilities are developed to their fullest potential.

Evidence cited earlier demonstrates that some abilities have potential for training and that designers given skill enhancement do improve their solution capabilities. Research in this area is still in its early stages, and further investigation is required before firm conclusions can be made and a definitive prospectus for design education drawn up, but the issue has received attention in the recent literature (Schon, 1987; Bray, 1988; Kendall, 1989). Optimism is strong that, given requisite intelligence, all people may be helped to move from their present level of design ability to one that is higher - not necessarily to the peaks of Edison or Einstein, but to a level of competence.

As a final note to the discussion of talent and skill, Schon (1987) suggests that design capability is best acquired through a "disciplined initiation" into the setting and solving of design problems. Talented students learn, he suggests, "by a kind of contagion", through exposure to master practitioners. They must begin designing in order to learn to design. The role of the master designer in such a process is to facilitate the students' process of self-discovery. The student cannot be *taught* what he needs to know but he can be *coached*:

> He has to see on his own behalf and in his own way the relations between means and the methods employed and the results achieved. Nobody else can see for him and he can't see just by being 'told' although the right kind of telling may guide his seeing and thus help him see what he needs to see (Dewey, 1974, p.151).

The teacher cannot simply describe how to design because in the process of knowing-in-action there is always a gap in meaning between the description and the doing. The limits of description are set by a designer's inability to say what he knows and by the inherent inexpressibility of right brain knowledge. The student learns by watching the talented and skilled designer and by attempting design himself. The teacher serves as a midwife to the student's process of self-discovery.

5.3 Conclusion

For urban planning, the purpose of theory that deals with design is not only to describe its nature but also to promote, in practitioners, an understanding of and facility with its procedures, methods and skills. This chapter examined design methods and the characteristics of the designer to provide information pertinent to this aim. Ultimately, the capability of the designer, his judgments and interpretations, his personal insights and awareness, go a long way to determining the success of design endeavors. In the absence of appropriate talent and skill, no method or stepwise algorithmic procedure will produce satisfactory design. It is the capability of the designer that closes the circle between process or procedure and effective response. Methods are no better than the person who uses them. They are tools, artificial aids to direct the designer's attention. It is the artistry in the designer's judgment and intuition, in the breaking apart and pulling together of problem elements, that holds the key for explaining the nature of design.

The discussion in this chapter isolates the role of methods within the design process and the characteristics of those individuals who might be expected to be "good" designers. In doing so, it contributes to an understanding of design within the generation of alternatives stage. It identifies possible areas of concern and ill-fittedness between a rational urban planning framework and design activity. In particular:

1. A further bounding of rationality, which results from the skill and talent needs of designers. How can the planning profession best meet the need for design-oriented individuals? Are these abilities outside the present range stressed by the profession? Does an urban planning framework place specific demands on the type of design skill required? Is the expectation of creativity realistic within the present framework for the planning process? How can suitable individuals best be incorporated in practical situations?
2. Impact of design methods. Are the types of methods described here practicable within real-world planning exercises? Do planners presently have the information and knowledge to make them work? Do planners presently possess the necessary abilities to utilize them?
3. Overall compatibility of the methods described here with the nature of planning.

The examination of these and other issues identified in chapters 3 and 4 are the focus of the next chapter. The picture of design and search painted thus far identifies important characteristics and aspects of generation activity that ought to be incorporated into a planning theory of alternatives generation. But there can be no wholesale transfer of information from one field to another. What remains is the evaluation of design and search activity in terms of the substantive and procedural focuses of urban planning.

NOTES

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1. In potential models, the amount of population allocated to any one zone is determined by the sum of interzonal potential for that zone.

CHAPTER 6

GENERATING ALTERNATIVES WITHIN AN URBAN PLANNING FRAMEWORK

6.0 Introduction

The preceding three chapters presented information from a number of disciplines in order to expose the nature of generation activity in a generic sense. They represent the essential first step in the development of generation of alternatives theory that is pertinent to the requirements of urban planning. The task in this chapter is to interpret the description of design and search presented thus far in terms of a distinctively urban planning focus. In this way, Chapter 6 becomes the core of the theoretical contribution of the thesis.

Every discipline has its own procedural, substantive and contextual foci which constrain the range and types of activity that are deemed acceptable or necessary to effective practice. This is not to say that they have fundamentally different ways of attacking problems. Yet, clearly, each discipline has its distinct rules of conduct and conventions, some explicit and some not, derived from the particular needs of that unique practical world. When integrating the general picture of search and design into an urban planning perspective, then, it is necessary to ensure that these distinctive features are given due and measured consideration. Potential areas of conflict and ill-fittedness between "good" planning and "good" design and search must be identified, and attempts made to reconcile the seemingly different needs of each for effective practice. It is necessary to consider how the nature of generation activity might be modified to accommodate the distinctive needs of effective planning without compromising good design and search. It must also be established where planning dictates are out of step with the needs of effective plan generation. This chapter serves a synthetic role within the thesis, bringing together hitherto unrelated points of information, extracting the essential features of design and search as linked spheres within the generation domain and placing the overall domain within a distinctly urban planning framework.

6.1 Integrating Search and Design within the Generation Stage

Prior to making any personalizing touches on behalf of urban planning, it is necessary to consolidate general information about design and search under a unitary framework. As different in form and character as design and search may be, they are joined together, ultimately, by their shared purpose in the decision-making process: to provide a range of well-spaced alternatives for decision makers to choose from as they determine the best course of action. Individually, each has a separate although inextricably linked task in meeting this purpose; together, they constitute the entirety of generation activity. As emphasized in Chapter 2, treating design and search somewhat separately to this point has been in the interests of conceptual clarity, ensuring that their individual characteristics and contributions to generation activity have been sufficiently acknowledged. Such an artificial distinction is not likely to hold in most practical situations, where the entire generation stage is driven by a singular purpose. It is necessary, in presenting the two activities as linked spheres within a generation of alternatives stage, to make a number of critical points regarding the nature of the linkages. Common purpose is not the sole reason for seeing design and search as being intertwined.

6.1.1 Adaptation

The most obvious other link between search and design comes from the relationship of existing knowledge to new form through the process of adaptation. Here, the practitioner takes an existing form, located in either internal or external memory stores, and redoes it. The resulting solution, while clearly linked to the old one, is somehow innovatory or new; output from the search process has clearly served as input for design. The practitioner tests an existing form against the requirements of his problem by attempting to apply it to the current setting. Points where the problem frame resists his attempts to impose a solution are areas that require customized response. In Schon's (1987; 1988) terms, the practitioner conducts a reflective conversation with elements of the problem setting, carefully interpreting and evaluating features of the current context with respect to his existing knowledge base. Areas of poor fit between existing solutions and the present problem might trigger further search activity, to locate more suitable solution forms, or they might trigger adaptive response. And adaptation occurs via the processes of knowing and reflecting-in-action - tacit, "black-box" processes not wholly amenable to either complete understanding or verbal description.

The knowing is made evident in the doing. The core of these processes was discussed, at length, in Chapter 4.

Two final points must be made about the adaptive process and the linking of design and search embodied therein. They are of critical importance to understanding the structure of generation activity presented in the thesis (Figure 2). First, the point at which old form is said to be transformed into something new, or where sufficient modification has been made to recognize innovation, is somewhat arbitrary. That is, the distinction between creativity and the routine application of existing form is blurred, and so too, as a consequence, is the division between design and search. It is tempting to say that this is a purely academic or intellectual problem, but that is not the case. Design and search require different skills and abilities on the part of the practitioner. Those possessing exemplary ability in one area may not be equally equipped in the other. This creates a potential problem in organizing the generation process and securing suitable practitioners, since it would appear, from earlier chapters, that a fluid transition between search and design and the freedom to go back and forth between the two, best meets the need for effective solution. This problem cannot be resolved in the thesis and requires considerably more extensive investigation. Still, it can be noted that informed opinion believes the ability to adapt existing solutions to be generally more widespread than the ability to derive de novo form (Harrison, 1987; Kendall, 1989; Dacey, 1989). And since the *need* for adaptive response would seem to be more common in the real world than the need for completely innovative response, there is ground for some optimism. The fundamental point remains, however, that the overlap between search and design, through adaptive response, has important ramifications for operationalizing generation of alternatives theory.

The second point, which is a rider to the above discussion of adaptation, is that the principal role of search is still to identify existing solution forms and that they might be transferable and usable in their existing state. This is why search activity cannot be considered a mere stage within design as some of the design theories seem to suggest. The identification of existing forms is conceptually and methodologically distinct from the activity of rearranging or modifying them. In recognizing that existing solutions might be deficient in their present state, though, the driving force behind search activity must be to understand the demands of the problem for any solution form, be it existing or innovatory. The overriding aim must be to ensure good fit between problem and solution, molding solutions to the shape of the problem, not molding the problem to fit solutions already at hand. This underlines a broader point about the role of analysis within the generation phase. All analytic activity must be driven by the need to achieve sound understanding of the problem, since understanding is fundamental to both effective design and search. In this sense, analysis serves an overarching role in generation activity as the basis upon which both search and design begin (Figure 2). Similarly, as problem-solving proceeds and the practitioner acquires more information as a part of either search or design he returns to the all-embracing analytic phase. Once again, the distinction between the two activities is blurred in operational terms.

6.1.2 Relationship Between Search and Primary Creativity

With respect to totally new solutions, the relationship between search and design is no less significant, though less obvious. Innovation occurs within a specific context and against a background of knowledge that primes the pump, so to speak, for the creative spark of genius to flourish. Even in situations requiring primary creativity, the practitioner relies on knowledge she brings to the problem setting. As she approaches the design task, she treats her past experience and learning as a point of departure from which to build the derivation of new form. She interprets the problem in light of what she knows, selecting, transforming and composing pieces of knowledge in new ways, to create a solution that represents an appropriate framework of thought. In doing so, she responds specifically to the signals she is receiving in her current problem setting. The new solution is related, somehow, to the existing knowledge contained within her internal memory although the precise nature of the relationship might be difficult to discern from the new form. Nonetheless, existing knowledge has played a role. The designer might not engage in physical search, through external memory sources, but evidence presented in Chapter 4 suggests that search on a cognitive level is a virtual certainty. And search on either a cognitive or a physical level allows the designer to obtain access to existing information stores, to draw on a multilevel structure of design knowledge, from specific context-dependent precedents to generalized, highly abstract concepts, prototypes and rules (Oxman, 1990). Searching through these structures to select relevant knowledge and relate it to the problem at hand can be regarded as part of the creative process. In this sense, search plays a role in the metamorphic process of design. It serves as a springboard for creative response.

In more concrete terms, search is linked very practically to the process of design, when practitioners begin a problem-solving exercise hoping to find an existing solution that fully meets their needs, yet fail to do so. This failure then drives them on to creative endeavor, a sequence that is not uncommon in real-world settings where practitioners often treat design as a last resort, to be avoided whenever possible (see Chapter 3). In this sense, design becomes a subsidiary and optional process. The distinction between this description of search and design and the one immediately above, where search serves as a springboard for design, is subtle yet significant, since it reflects a profound difference in the practitioner's overall orientation toward the task of generating alternatives. Where design is considered a contingent activity, triggered only by failure to identify existing alternatives, the aims of betterment and of securing the best possible solutions play second fiddle to pragmatic concerns. By contrast, when search and design are treated as parallel, interlocking processes, the driving force is clearly to achieve the best fit between the unique features of a problem situation and the character of solution forms. As should now be readily apparent, this latter aim jibes perfectly with the appropriate focus for generation activity, as advanced in this thesis.

At the same time, to view design and search as parallel processes does not mean that some search activity will not precede the creative flash. Clearly it may, but the seeds of design are still being nurtured from the time search begins. Opportunities for innovation are anticipated and exploited as a necessary part of the overall generation task. In addition to identifying existing alternatives, search has the potential to serve as a catalytic agent for design.

6.1.3 Relating the Nature of Planning Problems to the Structure of the Generation Stage

An equally compelling reason for treating search and design as parallel, overlapping processes was foreshadowed in Chapter 4: It is impossible for practitioners to know in advance whether they are facing a well-defined problem or a wicked one. Leaving aside, for the moment, the fundamental assertion of the thesis that *both* search and design are essential to proper, rational decision-making, it becomes necessary for the practitioner to treat them as complementary in order to achieve adequate understanding of the problem. The understanding comes through the processes of framing and reflecting, viewing the problem-solving process as a global experiment which begins with the practitioner seeing the problem "as" another in his problem-solving repertoire (Schon, 1987). This means that he interprets the problem in terms of his existing knowledge; indeed, he cannot be expected to see it in any other way. This does not mean that he assumes the problem *to be the* *same as* one addressed elsewhere, but that he is open to any similarities it might share with known problem and solution frames. In this manner, he tests the bounds of his own understanding and gains a clearer picture of the problem at hand. Joe Planner might reason, as follows:

> This public transportation problem is like the one I read about in Every Planners Journal, where they solved it using strategy "A". What if I try that here? Well, I'd have to change some of the things they did - our workforce is distributed differently, income levels are much higher and the population densities are lower. What if I modify the road network as follows..?

And so on and so on. As the practitioner applies existing frames to the current problem, he may encounter "surprises", aspects of the problem that do not fit his existing frames. These surprises trigger online adjustments so that further moves embody new-found understanding. The practitioner assesses the success of his interpretation by listening to the surprises and constructing a response in the form of new or modified moves. These new moves begin the process of assessment anew until ultimately the practitioner achieves a satisfactory solution form. Initially, though, it is by treating the problem as one present in his current repertoire that he gains a point of entry into the problem space and can exploit what he knows already. At the same time, by being open to surprises and ready to change his understanding of the problem to fit these surprises, the practitioner provides the medium for innovatory response. Once again, it is apparent that analysis plays an overarching role in the generation phase, driving the practitioner on to search and design according to the needs of the problem. These needs are of course determined with reference to the overriding aim - to promote effective decision-making response through the derivation of sound alternative solutions.

6.1.4 Summary of the Linkages Between Search and Design

In sum, there are a number of compelling reasons for treating design and search as linked, overlapping processes. Despite the overwhelming tendency, in the literature, to make black and white distinction between design and search, there is no sound basis for such a rigid division in cognitive process theory or empirical accounts of problem-solving behavior. What seems more likely is a fluid transition between the two processes, with search playing a role in all design. The precise nature of that role is a function of problem-solving context - the nature of the problem and the skill, knowledge and cognitive style of the practitioner. This means that the actual contribution of existing knowledge to new form is difficult to pin down. So too, then, is the point at which search ends and design begins. There is no objective standard for determining whether a solution is the result of pure search or whether some design was required in its application. If a practitioner borrows a particular concept, or set of principles, in toto from elsewhere, yet is required to provide it with a concrete physical form in the new setting, is the resulting solution design or search? Most likely, it is a mixture of both. The important point is that the nature of the overlap between design and search is a grey area, and this has both practical and theoretical ramifications for the generation of alternatives stage. The two activities remain distinct from each other by virtue of their different roles in meeting the overall aim of generating well-spaced decision alternatives. But, recognizing their links and the role of context in defining those links is an essential step in addressing inadequacies in planning process theory. It underscores the fundamental point that there is no convenient, recipe-like structure for generating alternatives.

6.2 Generation Activity within an Urban Planning Framework

In the thesis thus far, the discussion of design and search has centered on their capacity to produce solutions. The issue of these solutions qua alternatives has received cursory consideration. This is because the disciplines from which much of the information has been taken have no intrinsic need to consider alternatives as essential features of their practice. Planners, by contrast, must do so, as Chapter 2 made plain. It thus becomes necessary to place discussion of design and search within a distinctly urban planning framework. Two factors play a pre-eminent role here, by virtue of their importance to the overall purpose of planning in society. The first is rationality; the second, the socio-political character of planning. Together they set a basis for interpreting conceptual, ethical, methodological, practical and other general considerations regarding the appropriate form of generation activity within the planning process. The other factors mentioned in Chapter 2 - context, the spatial framework, uncertainty, future orientation and the variable nature of the planning task - impinge on the generation stage in a more circumscribed sense. They set constraints and standards for the practical development of process and method, yet leave aside broader philosophical and ethical concerns.

The process of integrating search and design within an urban planning framework is one of mutual adjustment, where sound generation practice must be ensured without violating the integrity of the overall planning process. It is not possible to resolve all the areas of ill-fittedness between "good" planning and "good" generation practice in this chapter, but in making plain the areas of concern and points of conflict lies the foundation upon which further study can begin. Herein lies the hope for improved planning decision. And lest we forget, the stimulus for this kind of investigation is the notoriously poor performance of planning solutions, in practice.

6.3 Rationality and Generation Activity

In Chapter 2, rationality was identified as the basic rule for guiding responsible decision making. The rational choice is the one that best meets the aims or goals of the planning exercise when measured against the other options.[1] Rationality sets the framework for evaluation and justification. As a corollary, it places specific demands on the nature of alternatives and generation activity, since these ultimately form the foundation upon which rational choice is made. Thus, generation activity must be motivated by the specific aims of the particular decision-making task and it must be able to ensure a variety of different options. Concomitantly, alternatives must be relevant and in sufficient number to ensure that informed comparison and evaluation can be made. On the surface, rationality places no restriction on how alternatives are derived or where they come from - only that they conform to rigorous performance specifications and evaluative procedures once developed. At the same time, given the descriptions in chapters 3, 4 and 5 - of cognitive processes, normative and descriptive models and practical failings - it seems obvious that rationality must also play a strong conditioning role in defining appropriate derivation activity.

6.3.1 Rationality and the Nature of Design

The obvious area of concern is the ability of search and design to ensure a sufficient number of alternatives so that the evaluative exercise and resultant decision offer some assurance of sound decision making. This was Alexander's (1986) worry, when he suggested that the black-box nature of design could be a severe constraint on rationality. The designer's inability to direct and control the creative process, to perform on demand, and hence to ensure that innovative solutions would be derived at all within a generation exercise, was taken to mean that the options put forward for evaluative purposes might be more meager than needed to promote truly responsible choice. The thesis has shown that this concern is not without foundation. Despite years of study in a number of fields, knowledge about creativity, though growing, is limited and likely to remain so because cognitive processes elude direct observation and thus complete description and understanding. We see results from creative processes and can follow their trajectories using such devices as protocol analysis, but we are restricted, ultimately, to what the creative individual is able to report or demonstrate about his cognitive activity. At the same time, there are grounds for some optimism and indications that the concern may be somewhat overblown. First of all, the concept of a bounded rationality is not a new one. As indicated in Chapter 2, rationality must endure a number of cognitive, organizational, social, political and other situational constraints which limit its application in a pure sense. But these limitations do not detract from the wisdom of choosing the course of action that will best meet the aims of the decision-making task. What we require is a new definition of "best" in light of practical and cognitive realities, a recognition that rationality of decision is a relative concept, with rationality judged in terms of the particular circumstances of each decision-making task. There is no reason to suggest, just because a complete set of solutions can rarely be identified, that the planner should not attempt *as wide a range as possible*.

The problem occurs, of course, where creative solution is absolutely essential because no existing solutions (derived from search) are suitable - where the decision-making task, itself, is somehow new and requires a similarly new response. It is true that there is no guarantee creative response can be produced within the time and other situational constraints facing the planner. Yet there are a number of factors, identified in Chapter 4, which increase the likelihood that innovation will occur - the foremost of which is ensuring that the "right" people are part of the generation process. It is not necessary to repeat here the lengthy list of creative characteristics, but only to emphasize that there are a number of cognitive and personality traits and analytic and synthetic abilities that are strongly affiliated with design response. Moreover, evidence suggests that some of these can be taught or at least enhanced in those individuals possessing the requisite inborn capacities. Yet, even if further study were to show that creativity is more properly the province of what Schon (1987) calls divine grace, or mystery and magic, efforts can be made to include those with proclivities for this magic in the planning process. It is not uncommon for other professions to screen individuals prior to admission to training schools. Planning could follow suit.

Creativity testing has been the subject of much investigation since the 1950s, and a number of different tests have been proposed to assess the varied facets of the creative mind (Jaquish and Ripple, 1980; Torrance, 1982; Dacey, 1989). In particular, Mednick's remote associates test has proven remarkably successful in assessing creativity in artists, architects, science and math teachers, college professors, and graduate psychology students (Mednick, 1962). The test is especially good at distinguishing between highly creative, ordinarily creative and minimally creative subjects (Dacey, 1989). So, it is not unreasonable to expect, in the interests of sound decision-making, that planners employed in generation activity should possess creative ability.

However, this does not mean that every planner must be creative. That would be an unreasonable condition, since primary creative ability is relatively precious. Moreover, the varied tasks associated with planning generally, and generation activity specifically, mean individuals possessing other skills and abilities will play an equally valuable role. But because design is always important to generation activity - as an absolute necessity in some cases and highly desirable in others - attempts must be made to ensure creative input. Whether this comes from individuals retained on staff, through a design competition or from consultants brought in specially on certain projects is a matter of organizational choice. The overall point is that there are a number of things an organization can do to facilitate creative response. It is obligated to do them, in the interest of promoting effective, rational decision. Though such effort does not nullify Alexander's concern, it does open up the prospect of loosening the bonds that creativity places on the rationality of decision.

What must be stressed again is that the absolute need for design response in day-to-day decision-making tasks is relatively small. This does not mean that attempts at design are not highly desirable. It is, after all, the only means for improved response - for moving beyond the mundane and the routine to potentially more relevant, better fitting forms. But, in most cases, a lack of creative inspiration can be offset by existing solution forms. Given a sincere but unsuccessful effort to promote creative response, planners must go with what they have at their disposal. The same is true for all other practical disciplines. Physicians may not be able to cure some cancers or AIDS, but they must treat their patients nonetheless. Where innovatory response is essential and an adequate range of solutions has not been developed, planners must weigh the costs associated with delaying their decision in hope of arriving later at improved solution forms. If the need for decision and action is immediate, the designers might take a lesson from the strategic choice approach which embodies a healthy respect for uncertainty and incomplete information in the decision-making process. Here, as described in Chapter 5, decisions are taken with the maximum regard for preserving freedom to change course if such change becomes desirable or necessary in future. And while such flexibility is not always possible (once a landfill site is established or a road network set down, choices become irreversible from a practical standpoint) it can be incorporated in some instances. Planning for the Mill Woods district, the subject of the next chapter, serves as a case in point. Here, planners designated blocks of land within proposed neighborhoods as "urban reserve" so that future planners, possessing better information about resident needs and demands, could make a final land use designation at an appropriate time.

In sum, failure to fire the creative spark rarely spells disaster for the entire generation process. In this sense, the bounds design places on rationality are relatively loose. It is only when innovation is essential to developing an adequate range of response that rationality is compromised. Even then, planners might adjust other aspects of their decision-making practice to accommodate this additional constraint. The overall point is that design is not as problematic to the rational planning process as Alexander suggests.

One reason, that merits some elaboration, is that even when design is required, primary creativity plays a small part relative to adaptive response. Because few problems are completely unique, it is sufficient in most instances to modify existing solutions to take count of any unique contextual features. Since more people are adept at this type of design than primary creation it is also more practicably possible. In fact, in fields such as architecture and planning, adaptation is more the norm than the exception as practitioners address contextually-situated problems (Kendall, 1989). For whatever reasons adaptive response is more tractable than primary creativity, its promise lies in that tractability. It is realistic and attainable within ordinary organizational problem-solving resources.

6.3.2 Rationality and the Design Process

Another area of concern about design and rationality relates to the discussion of the design process in Chapter 4. The issue here is not whether creativity can be achieved when required, but whether the two process models meet the demands of rationality for relevance and variety. Jones's analysis-synthesis-evaluation model was presented as a normative conceptualization of the three activities central to creative solution. It was also suggested that his model seemed, on the surface, to provide a good fit with the rational planning process since it encouraged the designer to generate a number of potential solutions. Yet, disturbingly, in Jones's own presentation of the process and in most other descriptions of design (particularly in architecture), the commitment to alternatives is more posture than real intent. Very quickly, discussion degenerates into a situation where the designer is primarily focused on deriving one solution, or at best a limited few. The initial recognition of the need and potential for variety is not mirrored throughout much of the accompanying discussion. For the purposes of rationality, and hence planning, this shadowy commitment to alternatives is inadequate and must be solidified.

Two points are of particular importance in relating design process models to the needs of rational planning. First, design processes that downplay or ignore the explicit development and evaluation of alternatives do not necessarily do so from the position that alternatives are irrelevant. Rather, it is presumed that designers have the right and competence to rule out alternative forms on an informal basis as analysis and synthesis proceed. By virtue of some innate designerly wisdom they recognize the best choice, intuitively, and exercise arbitrary control over the choice process. Leaving aside, for the moment, the hazard in such an approach for the social/democratic purpose of planning, there are other grave concerns about it. First, as was evidenced in the discussion of the design process in Chapter 4, there is good reason to believe that designers are not particularly adept in making informal, ongoing choices. They often rule out alternatives that prove, subsequently, to be worthy of more serious consideration. In some cases, analysis might be insufficient to make an early evaluation, given the complexity inherent in design problems. In others, alternatives may not be sufficiently well-defined to enable meaningful comparisons, and hence justify commitment to any one choice.

Second, evaluation within a rational planning process is done in comparative terms: is solution "A" or solution "B" better able to meet the aims of the planning exercise? If some alternatives have been discarded early on in the design process, it is unlikely that relative merits can be properly assessed. The actual value of a proposal might only emerge as it is compared with other solutions at similar stages of development. Rigorous assessment between ends and means, the very foundation of rational decision-making, is thwarted by informal and implicit evaluation in which alternative forms are summarily dismissed by the designer. To protect the integrity of the entire decision-making process, and to guard against flaws in the planner's own reasoning process (and the planner, after all, is only an agent of the decision maker), evaluation of options must be an explicit step, where alternatives are laid out and compared in like terms.

It can be concluded, then, that whatever design process is used, it must contribute to the development of a range of alternative solutions. This may mean, particularly in the case of the conjecture-analysis model, that the designer will have to conduct the process more than once, changing his assumptions and interpretation of the problem to generate a number of wholly-different solution forms. Some of the design methods discussed in Chapter 5, such as lateral thinking and reversals, are particularly helpful in stimulating the new frameworks of thought that are needed. The important point is that design process models that seem to promote the development of only one alternative might be appropriate as a subset of the larger generation task. Remember, rationality says nothing about where the individual alternatives come from, or how each one is derived. If the designer arrives at option "A" by conjecture-analysis, so be it. If he arrives at it by conducting extensive preliminary analysis prior to any synthetic process, no problem here either. Even if he conjures it up by carrying out a ritualistic ceremony with spirits of a nether world, rational principles have not been contravened. At the risk of becoming annoyingly repetitive, contravention arises only if no other solutions are forthcoming. That is, the range of generation activity, or of design process, must be sufficient to ensure a range of relevant alternatives.

If, as some suggest, a designer is capable of coming up with only one conjecture at any one time - that to expect more is impractical from a cognitive standpoint - then the need to develop sufficient range means it is necessary to include a number of designers in the process. They might operate, for example, under a team framework, or variety might be sought through a design competition. The latter is familiar in architectural circles, but it has been used occasionally in urban planning situations. One famous example is the design for Espoo, a Finnish new town for 90,000 inhabitants (Reynolds, 1967).[2] The design process in that case was judged particularly successful because of its clearly articulated evaluative criteria, derived in advance and adhered to throughout the design competition. If, on the other hand, one designer is capable of generating a number of alternatives himself, by shifting his own interpretive framework and arriving at a variety of different, equally valid problem frames, the need for a number of designers is somewhat diminished. It was suggested earlier, however, that this ability is most likely limited to the most creative of the creative lot, so that a number of designers might be the preferred norm. The larger point is that planners must structure the generation process to ensure not only the requisite skills and abilities for designers, but also the necessary variety in design approaches to ensure a well-balanced range of solution forms. Again, there is no recipe for success.

Finally, in this consideration of design process and rationality, and the appropriate blend and sequencing of analytic, synthetic and evaluative activities, it is necessary to discuss what constitutes "sufficient analysis". Advocates of the conjecture-analysis framework place little emphasis on extensive preliminary analysis, being content to rely on each designer's intuitive capabilities to detect a correct response very early in the design process. They suggest that sufficient analysis of the problem occurs after the embryonic form has been proposed, when the designer sets out to disprove a hypothesized solution and subjects its every facet to rigorous testing. In practice, however, designers set out to confirm the validity of their pet plan, an entirely different analytic focus which tends to exempt the solution from serious critical scrutiny (Rowe, 1987; Mann, 1987). Even if analysis is undertaken seriously, it is only in relation to that one problem frame, so that the analytic process is less than desirable from a rational standpoint.

Others see merit in conscious and deliberate analytic investigation as a prelude to serious solution proposal. This does not prevent the designer from proposing a conjectured solution, even early in the design process, or from wandering back and forth between analytic and synthetic realms as the need arises. But it does mean that conjectures must come from at least a basic understanding of the key factors influencing the problem at hand - an understanding acquired through sound analysis. In this way, analysis works to ensure that the conjectured solutions with which the designer reasons her way through the problem-solving process are at least minimally relevant at the outset. Again, for some, understanding will come faster than for others; it might even appear to come instantly on the basis of a few cues in the environment. And the understanding the designer does have, be he novice or expert, will no doubt shift and improve as the reasoning process progresses, using whatever conjectures, models and types are necessary to the task.

Requiring sufficient analysis prior to synthesis ensures that conjectures will be relevant and reasonable. Even practiced designers might benefit from conscious preliminary study, taking a step back to reflect upon their preconceived beliefs. Ultimately, though, definitions of what constitutes sufficient must be left open-ended - to account for variability in problem structure and the personal qualities of the designer. At the very least, "sufficient" must mean that which enables the designer to field a reasonable interpretation of the problem, with awareness of other possibilities. This places the onus on the designer to define sufficient according to his own skill and knowledge and the particular problem at hand. Sufficient must be seen as a relative term.

One final point must be made about the role of analysis in the design process. Requiring preliminary analysis does not negate the importance of ongoing analysis throughout synthetic portions of the design process. Indeed, the reflecting-in-action that Schon (1987; 1988) speaks of plays an equally important role in ensuring relevancy - perhaps more so. Analysis must permeate the entire design process, starting before problem frames are set. It is a safeguard against personal errors and personal prejudice. It forces the designer to widen his point of view, to look beyond the obvious, and so promotes consideration of a wider range of possibilities. Ultimately, the role of analysis is to ensure relevant alternatives. Its only vested interest must be to promote the best possible understanding of the problem and the best possible fit between problem and solution. Only then will analysis be sufficient.

6.3.3 Rationality and the Nature of Search

When Alexander (1982, p.288) assessed the fit of search and creativity with rationality, he concluded that if the generation activity is largely a matter of search, "we need not be concerned about possible limits on rationality from this aspect". Search, he suggested, is "a significant rational element" in plan generation, a "relatively routinized" process. Yet, clearly, from the empirical evidence presented in Chapter 3 and the discussion of information processing in Chapters 3 and 4, the translation of search activity into a wide range of relevant options is not as automatic as Alexander seems to imply. While the practitioner can direct the nature and breadth of his search, there are a number of variables he cannot control, such as the quantity and quality of information available. If there are no suitable solutions in the external memory, search activity offers no greater promise for rationality than does design. Moreover, as already discussed in section 6.3.1, much of what is found through search must be adapted to make it truly relevant.

The point here is not to quibble with Alexander's basic argument: overall, search is less problematic than design. My intent is only to emphasize that there are serious enough concerns that practitioners should not be lulled into a false sense of security about search's ability to produce the requisite alternatives on demand. Search must be undertaken with extreme attention to rigor since breadth and depth of search are both factors in the likelihood of success. The practitioner must also be conscious of potential informational shortcomings affecting both the quantity and the quality of solution forms. As well, some individuals will be better searchers than others so that, as with design, care must be taken to ensure that properly-skilled people are engaged. In sum, the important point about search comes in the form of a cautionary message: in certain situations, the search process can pose a significant threat to rationality of decision making. More than with design, however, the power to minimize this threat lies within the control of practitioners through improved information storage and retrieval systems.

6.4 Relating Generation Activity to the Socio-political Character of Planning

Much of the above discussion about rationality and generation activity applies equally well to a consideration of the relationship of generation activity to the overall purpose of planning. The chief point of difference is that the motivation for seeking a wide range of relevant options is defined in socio-political terms and with respect to the ability of planning to promote responsible decision making on behalf of some larger social good. A vital consideration here is that all points of view should be represented in the decision process. Decision makers must understand the range of choice at their disposal before they commit to any one course. In this sense, the nature of planning as a socio-political process provides substantive guidance to generation activity, since the range of alternatives that planners identify should match the variety of interests affected by the decision to be made. Each alternative represents a different point of view, so to speak, and serves to widen the decision makers' perspective of the problem.

In terms of the procedural aspects of generation activity, the socio-political purpose translates into clear prescriptions for the type of practice that is acceptable in deriving solution forms, especially with respect to design. Most obviously, since it is never acceptable for the planner to view a problem from the perspective of only one interest group, he must engage in the type of design activity most likely to provide him with the necessary range of solution forms. For example, if he utilizes a conjecture-analysis model, he may have to repeat the procedure several times, consciously varying his initial assumptions so that different conjectures emerge each time.

Where the conjecture-analysis framework is decidedly more problematic, in this context, is in its implicit acceptance of the designer's right to carry out informal evaluation, narrowing the choice range as part of the conjecture-analysis cycle. Remember, the designer derives his conjecture "by innate sensibility", "divine grace" or some equally mysterious cognitive process. To question the accuracy of his judgments, or to request justification for his decisions and choices and for his one view of the problem, is seen (particularly in architectural circles) as an affront to his professional dignity and proficiency as an artist. It is the emperor's new clothes syndrome where outsiders are reluctant to question apparent problems or irregularities in the face of some potentially wiser person or greater authority; no one wants to appear foolish. Such an attitude, and the intensely private process it protects, are clearly at odds with the nature of planning as a public process where the planner serves as an agent of society. The planner must be prepared to open up the design process to scrutiny, to offer reasons for his judgments and decisions, to demonstrate a willingness to respond to other equally valid points of view. This is not to say that he can or must fully explain how he arrived at particular interpretations or choices - that is, be able to dissect his own creative process. But he must be able to justify his decisions after the fact; to offer explicit evidence that his generation process was rigorous and his judgments well-reasoned.

This was the intent of the three-stage recording system proposed by Jones (1963; 1981) as part of the analysis-synthesis model. It encouraged the practitioner to evaluate his own thought process while opening his judgments to debate and scrutiny by affected parties. The model, which has been marred more by critics' misinterpretations than by any inherent flaws, merits more sensitive investigation than it has received to date. Its emphasis on explicit and systematic analysis and evaluation meshes well with the socio-political character of planning.

In support of Jones's analytic-synthetic framework, Archer (1965) identified three circumstances that he felt justified systematization of the design process:

1. When the consequences of being wrong are grave.
2. When there is a high degree of uncertainty.
3. Where there are a number of interacting variables.

Obviously, all three circumstances apply to planning. Archer suggested that systematization would promote greater likelihood of solution effectiveness and would offset the high degree of design failure observed in the field. It would provide a guard against design error. And while more recent evidence suggests that early efforts to order and sequence the design process were somewhat naive, given the complexity of cognitive processes and our limited understanding of them, there is no reason to question Archer's belief in rigor and attention to detail. There is no basis for rejecting his attempts (like Jones and other similarly motivated methodologists) to open up the design process to critical reflection, even if much of the justification for decisions and judgments is reasoned out after the fact. Just knowing that such accountability is required, that it is no longer acceptable to sit back on expert laurels making arbitrary decree, might induce designers to greater care and attention during the design process.

Proponents of traditional design methods and the conjecture-analysis framework would no doubt argue that there is no inherent reason to suppose that solutions derived through processes where judgments are internalized and not brought forth for methodical, external evaluation, will be any less worthy than those derived with explicit, formal regard for analysis and evaluation. Granting a rather large benefit of the doubt, this may be the case. Such solutions might meet, perfectly, the tenets of rationality with respect to range and relevancy. But they do not meet the demands of planning as a public and political decision-making process. These demands are very clear: the planner must be able to demonstrate openly that he has addressed all of the relevant interests. He must be able to assure politicians and the public that his analytic and evaluative practices have been ethical and rigorous. The question of what is ethical is resolved with respect to the planner's attempts to ensure fair representation of all interests. So, while the automotive designer might get away with developing a single prototype for the best car of the 90s, or the advertising executive with a single slogan, the same approach is patently unsuited to a planning process that must be *democratic* as well as rational. The planner must not, in the interests of public planning, arbitrarily present a single landfill site or one lone conceptualization of a community, such as Mill Woods. As Marcuse (1989) observes, planning is part and parcel of a divided, competing society. The nature of generation activity must be derived from this fact.

6.5 Relating Generation Activity to the Substantive Focus of Planning

Within the framework provided by rationality and the socio-political nature of planning, other factors come into play which shape the effective deployment of generation processes and methods. These factors arise from the substantive focus of the planning discipline on the future physical arrangement of land use in an urban area. Planners require certain specialist abilities to be able to conceptualize land use patterns in a future context and in spatial, or visual, terms. They must be able to "future image" and they must be able to think graphically. In addition, because of the large amounts of uncertainty inherent in the planning task, they must be able to cope with intensely ambiguous situations. The need for these specialist skills adds yet another layer of complexity to generation activity generally, and to the design process in particular. The aim here is to outline the nature of this complexity and its implications for alternatives generation.

The ability to see new solutions or new images that are relevant is not what distinguishes the generation task facing planners from generation activity in general. To derive novel yet relevant form is, after all, the aim of all creative endeavor.

Rather, it is the need to forecast the future that sets planning apart. The planner must be able to design alternatives that are representative of a wide range of future possibilities, yet are firmly grounded in reality. These alternatives must be based on desires and goals for the city's future form, yet shaped by reasonable estimates of what is likely to occur. They must incorporate reasonable inference from experience and past trends while recognizing that deviation from these trends is a distinct possibility.

The generation of alternatives is thus inextricably tied to forecasting and prediction activities. In fact, according to some (McLoughlin, 1969; Vickers, 1974; Bracken, 1981; Simpson, 1985), it is necessary to conceptualize forecasting and plan making as complementary activities:

> Forecasting maintains a running representation, projected into the future of how things are going, and how, as assumptions they may be expected to go. The second [policy making] maintains a set of standards, projected into the future, which defines the state of affairs to be attained or maintained and defines a set of on-going actions designed to attain or maintain these states (Vickers, 1974, p.639).

In this sense, planners are required to forecast three aspects of the urban system: what will happen if the system stays on its present course, potential deviations from that course, and how various attempts to exert control will further affect the trajectory of change. This means that planners must have a clear view of the nature of the elements that shape the urban system and a realistic sense of the degree of control that can be exerted over them.

Over the last twenty-five years, considerable effort has been made to develop accurate forecasting methods. By and large, these attempts have centered on urban models of the type discussed in Chapter 5, and the criticisms that were presented there apply generally to most forecasting methods. First, most of the models are not based on realistic description and understanding of the processes and phenomena they seek to project into the future (Lewis, 1973; Sayer, 1976; Bracken, 1981). In the interest of mathematical tractability, the models make simplifying assumptions about real-world conditions that affect the accuracy of the predictions. In addition, forecasts are often made for population and each land use separately when, in reality, the interdependence of urban activities means each type of forecast is dependent on the other (Simpson, 1985).

A second concern about forecasting - and the most common criticism of current methodology - is its reliance on past and present trends as a basis for prediction. According to Chadwick (1978), when we formulate future actions, we do so on the assumption that the future will be largely like the past. Yet, the changes of the last half-century would seem to indicate that new contexts for planning emerge outside of these general historical trends. In particular, planners in the 1960s and 1970s geared their forecasts toward the phenomenal growth and urban concentration that was occurring during these decades (Hall, 1986). Then, in the 1980s, when slow growth and decline were the obvious trends, forecasts made during boom times fell out of line with reality. For example, population projections made fifteen years ago in the United Kingdom grossly overestimated requirements for school facilities. As a result, nearly 30 percent of school places lie empty today (Simpson, 1985, p.57). Economic and social changes and technological inventions are difficult to predict. Yet clearly, for planning to remain a credible activity, it must be capable of making realistic forecasts that recognize the variety of futures that are open (Bracken, 1981).

Hirschhorn (1980) suggests scenario-writing as one method for consciously promoting this awareness of potentially different future contexts. In particular, he advocates what he calls *developmental scenarios*. The present is used as a starting point, but rather than extrapolating present trends within existing contexts, an attempt is made to imagine a multitude of environmental and social conditions and the resultant new trends. This capacity to imagine new trends is what Baum (1977) calls future-imaging ability. Although there has been little investigation of this skill, Baum suggests that it is not evenly distributed amongst the general population. It may be that it is closely affiliated with creativity, however, since it too requires the ability to recognize different patterns and possibilities and to see new within the existing. Certainly, this area merits further investigation.

The ability to think in visual terms is another skill that warrants attention. Some of the tasks planners engage in require the translation of policy statements into physical form - the ability to process and manipulate spatial patterns. In Chapter 5, this ability was called "graphicacy", centering on the capacity to think in the form of images, or graphic patterns, to be able to perceive the world through models that are neither verbal, nor numerical, nor literary. It was speculated that this ability might play an important role in fostering creativity since image-based thought is inherently fluid and flexible when compared with the fixity of verbal, numerical and other codes. This speculation aside, visual thought is essential for many tasks in physical planning. So too is the ability to represent image-based thought in like terms.[3] Visuo-spatial thought is critical to the ability of the planner to create aesthetically pleasing environments - and, more importantly, functionally relevant and coherent spatial arrangements.

6.6 Conclusions

Sound generation activity within a rational planning framework is certainly a tenable aim. There is *no* inherent reason for presuming that the nature of either design or search activity contravenes the basic tenets of rationality or the dictates of planning as a socio-political process. Nor is there basis for believing that the need to comply with the shape of the planning task should interfere with effective design and search methods or processes. Being tenable, however, is not the same as being easy. This was made plain in the examination of forecasting methods and the difficulties inherent in the orientation of planning toward the future. The need to project plausible images of what the future will be like as a forerunner to generating plan alternatives adds another layer of complexity to an already complicated task. Since there are no ready recipes for deriving accurate assessments of the future, there are no formulas for constructing relevant alternative forms. At present, prediction problems are receiving much attention in planning literature (Allen, Engelen and Sanglier, 1986; Simmonds, 1986), and any advances will enhance generation activity as well. In the meantime, as was stressed earlier with respect to quantitative modeling, planners must operate from a realistic appraisal of what it is they are able to achieve and adjust their practice accordingly. They will have to approach generation activity with more ardor, rigor and caution than has characteristically been the case if they are to ensure an adequate understanding of problems and a sufficient range of quality options. These are the most basic requirements for generation activity within a rational planning framework.

The greatest inadequacy in planning theory, with respect to generation activity, has been its failure to address the complex nature of the overall task and the implications of this complexity for the ability of planning to deliver effective solutions in practice. By highlighting the character of design and search, and placing them within a distinctly urban planning framework, this chapter takes a step toward closing a gap in planning process theory. We see, here, that design and search have specific characteristics which make them difficult in their own right, each in its own way but design even more than search. We also see that their overlapping nature makes it impossible to separate them neatly into totally distinct activities. The problems plaguing one often have impact on the other as well.

When search and design are placed within an urban planning framework, specific concerns emerge. From the perspective of rationality, the concern is not where alternatives come from or how they are derived, but whether or not they will "come" at all; and if they do, whether they will be relevant and in sufficient number to uphold the spirit of rational choice. With respect to the social and political obligations of planning, the concern centers more on where alternatives come from, not so much in the sense of what specific methods and procedures were followed but whether they provide adequate safeguards of the public trust; that is, their explicit mechanisms for ensuring the planner's accountability for judgments and decisions he takes as part of the overall decision-making process. The planner is a public agent. His aim is to improve characteristics of the world where people live (Rittel and Webber, 1984). He does this by improving the choice process. Planners cannot afford the luxury of being wrong.

With this in mind, planners must approach methods and processes from other disciplines with caution. Those that rely on the designer's innate capabilities and permit him to propose a single, conjectured solution are valid only to the extent that the overall generation process compensates for their deficiencies measured in planning terms. That is, the generation process, overall, must ensure comprehensive analysis and as complete an identification of alternatives as is practicable. It does not matter where each alternative comes from. Within this framework, planners must be very careful in designating approaches from other fields off-limits or as inappropriate - particularly in the face of evidence supporting their effectiveness to derivation purposes elsewhere, or testimonials to their accuracy and relevancy. Rather, it would seem that the emphasis should be on incorporating what works, if possible, by adapting the structure of overall generation activity to accommodate these approaches. If one approach is not comprehensive enough or not rigorous enough on its own for the purposes of responsible decision-making, planners must ask how they can compensate for its deficiencies in carrying out the overall generation task. For planning to do otherwise than to conduct such a process of critical self-reflection is to leave its own practitioners ignorant of what is necessary to produce effective response. It runs counter to the purpose of theory for practical disciplines, like planning.

NOTES

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1. The reader is reminded that the idealized rational model has already been rejected as practically impossible. Decisions must be interpreted in terms of the difficulties inherent in the general nature of planning and the limitations imposed by individual contexts.

2. The competition for the design of Espoo was held in 1966-67. Competitors were given nine months to prepare and submit entries, some 170 of which were eventually received by the evaluating team.

3. It is not unreasonable to assume that some people will possess one skill and not the other (Muller, 1989). In particular, individuals are more likely to possess representational abilities, such as drawing and modeling, than the capacity to think in visual terms.

CHAPTER 7

MILL WOODS: THE PRACTICAL TEST

7.0 Introduction

Chapters 3, 4 and 5 described the nature of design and search in general terms while Chapter 6 related the characteristics of the two activities to an urban planning focus. As a block, these chapters addressed the first objective of the thesis and represent its principal theoretical contribution. Their aim was to close the gap in generation theory by providing substantial information about the principles and procedures of both design and search, their relationship to each other and their fit with the requirements of the urban planning process. This chapter addresses the second objective of the thesis by examining the practical difficulties inherent in the generation of alternatives through a case study of the plan preparation process for the Mill Woods community in south-east Edmonton. The third objective of the thesis is met in Chapter 8, where the case study is related back to theory.

As noted in Chapter 1, disciplines like urban planning rely on theory to explain the nature of their role in the practical world. Theory serves not only as a basis for understanding the objects of planning decisions and actions but also as a foundation for developing the skills, strategies and methods of good decision-making practice. It is, in short, a guide to effective action.

To fill the demands of this role, theory must be relevant to the constraints and opportunities of real-world decision making.

It must incorporate an awareness of the contextual factors that drive the generation task - those that determine the appropriate blend of search and design within a given decision-making episode, and those that work against proper generation activity. To serve practice, then, theory must be practical; both its descriptive and its normative components must undergo reality testing. In this vein, Chapter 7 explores the Mill Woods case study by focusing on the contextual elements that shaped the nature of generation activity undertaken by the Mill Woods Project Team. It is concerned with the period between April 1970 and April 1971, the twelve months when City Planning staff undertook to prepare an outline plan for the site. The aim here is not to evaluate the physical form of Mill Woods "on the ground" but rather to consider the evolution of the generation process in the following terms:

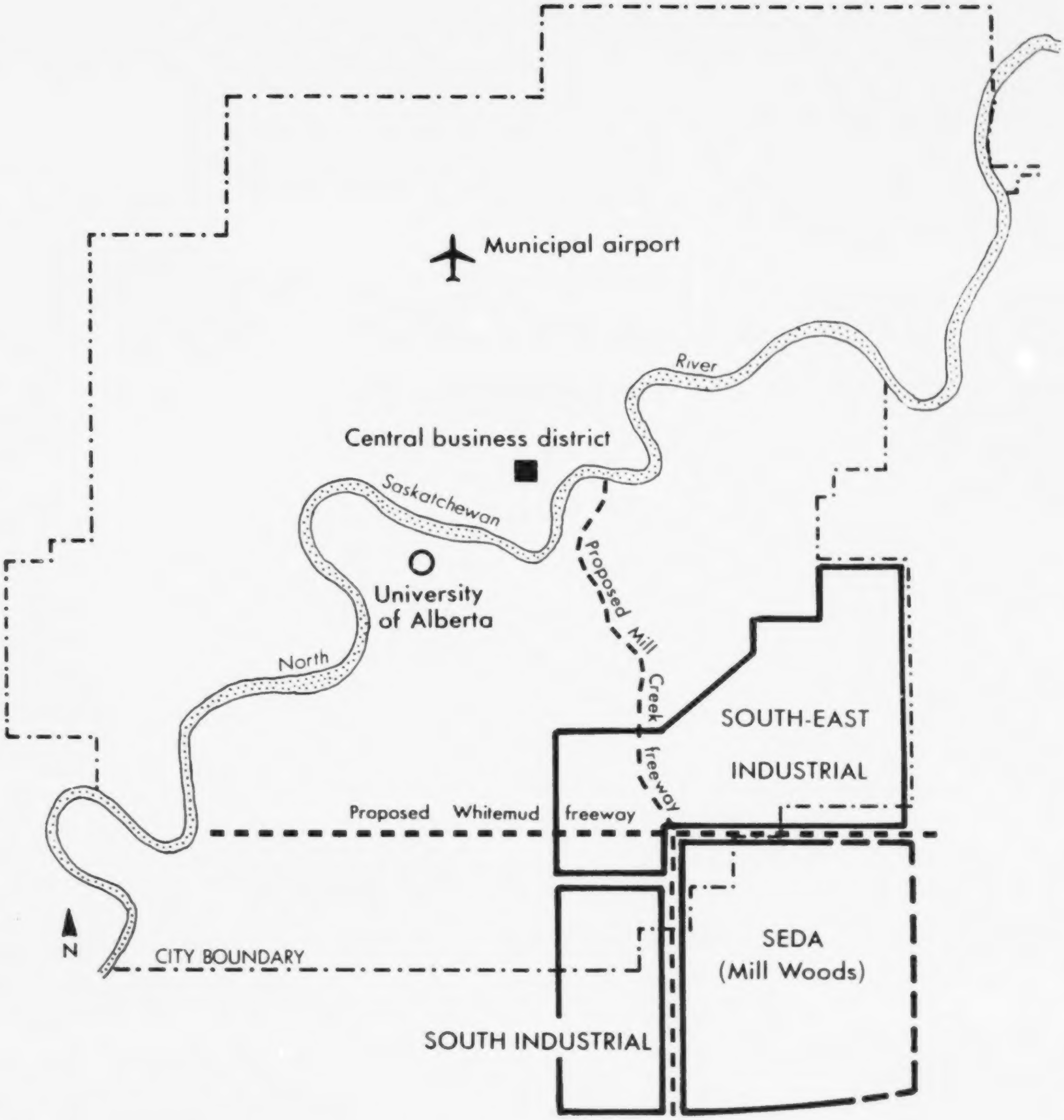
1. Nature of generation activity undertaken
2. Characteristics of the alternatives developed
3. Selection of final solution
4. Key participants
5. Constraints and opportunities inherent in the planning environment

This exploration serves to illuminate instances of poor fit between theory and practice, and so fuels the process of critical self-reflection that is essential to learning and growth within any practical discipline.

The rationale for selecting Mill Woods as a case study was laid down in Chapter 1. In brief, Mill Woods represents the most ambitious public landbanking venture ever undertaken by a municipal government in Canada. This alone makes it worthy of attention. Originating from a provincial-municipal agreement in

1969, Mill Woods encompasses some 2630 hectares of land and will ultimately house upwards of 100,000 people (Figure 10). Because the City of Edmonton retained all planning and development rights to the land, under the agreement signed between the Province of Alberta and the City regarding its purchase, planners were in the unique position of being able to exercise complete control over the evolution of the planning process and the substance of the area's physical form. Mill Woods gave them a golden opportunity to ensure sound planning practice, and was put forward as a conscious attempt to employ "the most advanced planning techniques"available (Edmonton, 1971, unpaged). In the twenty years since its inception, however, Mill Woods has suffered a great deal of criticism, at least some of which was aimed directly at the principles embodied in the original plan. Though the purpose here is not to confirm or refute the substance of the criticism, it may be possible to trace the rationale behind the decisions made by planners in selecting the area's physical form. That is, seemingly irrational choices may appear more rational when placed in contextual perspective.

In addition, planners seemingly undertook a systematically rational approach to plan generation. The process diagram that was printed inside the back cover of the *Mill Woods Development Concept Report* bears marked similarity to ideas of "good" process advanced in contemporary decision-making theory (Lang, 1987; Harrison, 1987; Kirk and Spreckelmeyer, 1988). This means that although twenty years has passed since the plan preparation process was undertaken, we might still learn lessons from it. The ques-


Municipal airport
River
Central business district
Saskatchewan
Proposed Mill Creek freeway
University of Alberta
North
SOUTH-EAST INDUSTRIAL
Proposed Whitemud freeway
N
CITY BOUNDARY
SEDA (Mill Woods)
SOUTH INDUSTRIAL

Source: Edmonton, 1970

Figure 10: Mill Woods : Setting

tions put forward in Chapter 1 are apt: Did the often-criticized form for Mill Woods emerge from good process or was the process that planners undertook somehow deficient? If it was deficient, what were the reasons for the deficiencies? The focus of the case study is the role of contextual factors in shaping generation activity. The point is to relate the specifics of the Mill Woods case study to the generalities of theory, to recognize and acknowledge the diversity and uniqueness that are inherent in different settings while capitalizing on similarities from place to place. Case studies such as Mill Woods provide food for theoretical thought, the means for proposing, testing, correcting, expanding and reformulating our ways of understanding the planning world.

7.1 Information Sources

Information about the plan preparation process for Mill Woods was obtained from documentary sources and from interviews with five individuals who were intimately involved with the preparation of the outline plan in 1970-1971. With respect to documentary material, the City of Edmonton holds various planning documents and records, correspondence, memoranda and minutes of meetings which pertain directly to the outline plan. In addition, one of the members of the Mill Woods Project Team made available twelve hours of tape recordings from a two-day seminar in July 1970, in which five consultants met with the Team specifically to assist it in its "preparation of an outline plan" and "the resolution of design problems" (Correspondence from Mr. E.S. Bishop to Mr. P.E. Ellwood, 17 July 1970). These tape recordings are in-valuable since they reveal the difficulties, constraints and pressures that Project Team members perceived at the height of their involvement. They also give a sense of the personalities involved and the relationships among team members. Because the recordings were never intended to become official or permanent archival documents, or for that matter available to anyone other than Project Team members, there was no need for individuals to hide behind politically or professionally correct postures. They were free to speak candidly about their concerns. These tapes, then, form a central element in the discussion to follow in this chapter about the difficulties and constraints that came to play in the generation of the Mill Woods development concept. Because the individuals who participated in the think-tank believed their comments would be a matter of private record, however, I have attempted to ensure the anonymity of specific comments where, in my judgment, they might be construed as inflammatory or sensitive. In other instances (in fact, most) it is possible to reveal the source of information and opinion without jeopardizing any of the individual professional reputations involved.

As a means of supplementing documentary source material, individual interviews were conducted with five of the key participants in the Mill Woods project. The first, Alex Kachmar, was a member of the Mill Woods Project Team appointed from within the City Planning department to devise the Mill Woods outline plan (Appendix I). The second, Stuart Bishop, though not a member of the five-man Project Team, was retained by the City to provide a "sociological consultation service" on social and physical design issues. Mike Welykochy, the third interview subject, also not an official team member, was the City planner assigned the task of providing direct liaison between the group of planners responsible for implementing the concept plan and those responsible for its preparation. He was an active participant in all Project Team decisions from the initial stages of concept development. Dave McCullagh, the fourth interview participant, was the Mill Woods Project Team leader, his role being to supervise the other four team members (three planners and a draftsman) and to communicate with more senior administrative officials and political representatives. The final participant, Mr. Phil Ellwood, was the Assistant Superintendent of Planning for the City of Edmonton at the time. He had the direct responsibility for overseeing the entire Mill Woods project, including planning, development and marketing phases. It was his vision that prompted the City's initial interest in the Mill Woods land-banking scheme and he, more than any other, was able to provide insights not revealed in the documentary sources.

In every case, a focused-interview format was used. This allowed participants to speak at length, in their own words, while ensuring that certain topics or issues were covered. In general terms, these issues fell into six categories:

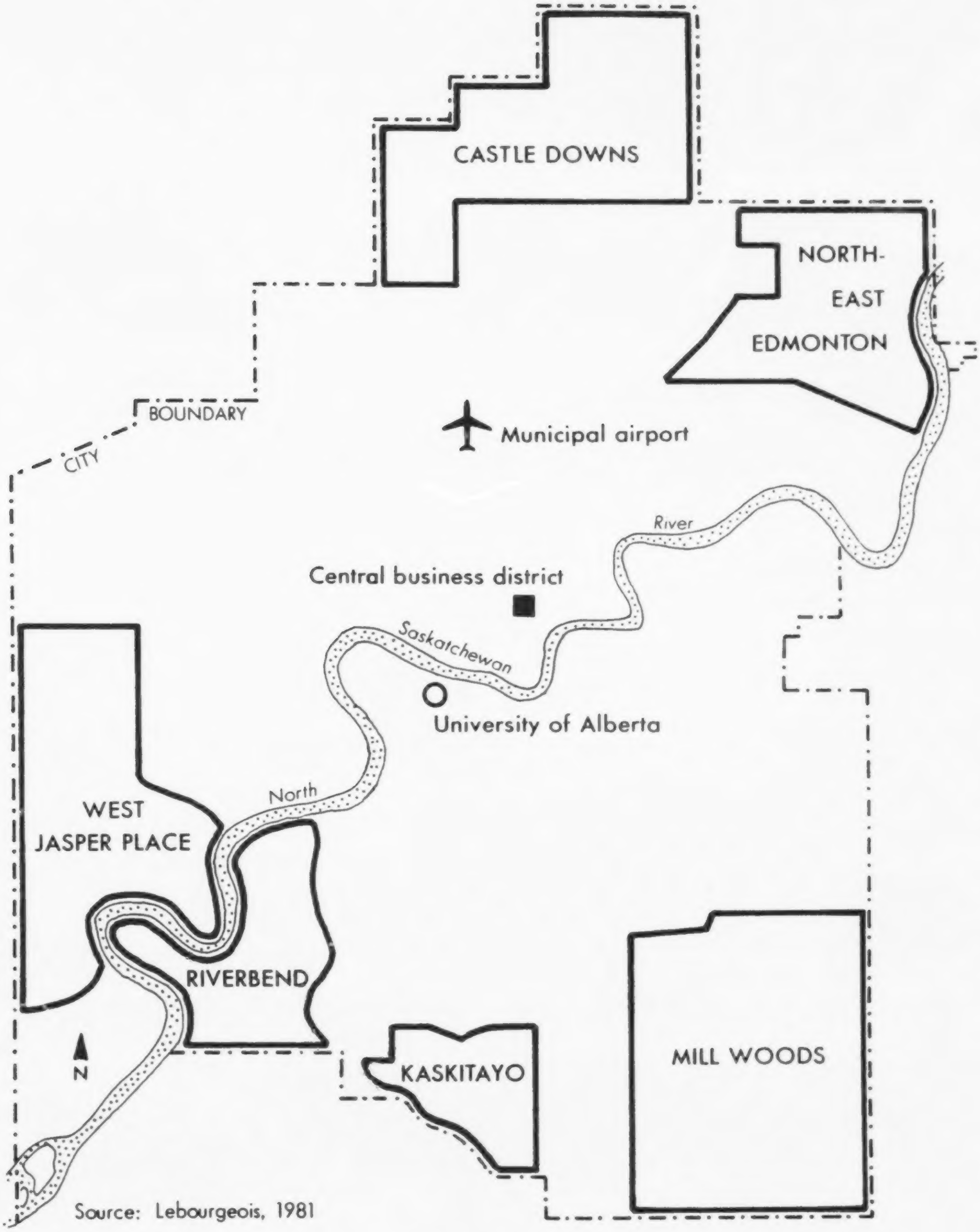
1. Evolution of the process
2. Nature of generation activity
3. Characteristics of alternatives
4. Selection of a final form
5. Constraints and opportunities
6. Role of participants

The prime advantage of the focused interview method is that it ensured a continuity of material on certain subject areas but did not restrict the degree of detail, the manner of response, or the context in which the subject chose to relay the information. This proved to be especially valuable in this study where certain factors, such as opposing philosophies between the Project Team and the Assistant Superintendent of Planning, and particular elements in the landbank agreement, were perceived by participants to have more prominence than I could have anticipated in advance. An alternative method relying solely on a series of predetermined questions might have lost the richness and detail embodied in all of the participant responses. Interviews were conducted during prearranged appointments, with the actual time of discussion ranging from one-and-a-half to two-and-a-half hours. Two of the subjects were interviewed twice since, by virtue of their particular roles in the process, they were able to provide substantially more detail and background than could be covered in a single session. These subsequent interviews were also approximately one-and-a-half hours in length. All of the interview sessions were tape recorded, by prior consent of the participants, and later transcribed. The taped interviews transcribed to the equivalent of roughly 150 typewritten pages. With regard to the anonymity of specific comments and opinions in the presentation of results, the same procedure was followed as was outlined with respect to the tape recordings from 1970.

7.2 Residential Planning: New Towns

7.2.1 The Philosophy of New Towns

As a lead in to the case study, this section provides a brief introduction to the principles and practice of residential planning at the time of Mill Woods, and sets a framework for understanding the larger context within which planning decisions were made. At the time of its development, Mill Woods was one of six large planning units, known as outline plan areas, for which comprehensive but general plans were prepared to assign the distribution of major land use and transportation elements within the development site (Figure 11). The purpose of the outline plan was to provide guidelines for development, a basis upon which detailed subdivision planning could proceed in an efficient, well-integrated manner. Planning on a large scale was done in the interest of reducing the servicing inefficiencies and land use incompatibilities associated with small scale "neighborhood" planning (Harasym, 1975; Bettison, Kenward and Taylor, 1975). The *Mill Woods Development Concept Report* makes it clear that planners looked toward new town planning theory, with its emphasis on the development of wholes, or unified suburban units containing balanced provision of housing, facilities, services and amenities, as a source of inspiration in their endeavor to plan a showpiece of new urban growth. The discussion of residential planning in the thesis therefore relates to these large-scale residential forms. Theory and principles are discussed within the body of the text, while specific examples of new town development have been catalogued in Appendix II.


CASTLE DOWNS
NORTH-EAST EDMONTON
CITY BOUNDARY
Municipal airport
River
Central business district
Saskatchewan
University of Alberta
North
WEST JASPER PLACE
RIVERBEND
N
KASKITAYO
MILL WOODS

Source: Lebourgeois, 1981

Figure 11: Edmonton outline plan areas, 1970

New towns, or new communities as they are often called, are acclaimed for their emphasis on comprehensive land use arrangement and their commitment to urban design. They permit the planner a blank slate upon which to build a model community relatively unencumbered by the constraints of prior development patterns, fragmented land ownership and other factors that limit the effectiveness of traditional residential planning efforts (Clapp, 1971). Some suggest that new towns are distinctive for their emphasis on all of the elements for a complete urban settlement (Burby and Weiss, 1976), while others suggest that the distinguishing feature rests more with their dedication to high-quality urban design (Rouse, 1966; Osborn and Whittick, 1969; Gallion and Eisner, 1980). Stanland (1972), for instance, maintains that they represent the ultimate vehicle for innovation in urban planning. It is also generally agreed that single ownership and control is the vital element in ensuring that the commitment to creating ideal living environments is met.

In sum, the successful implementation of the new community concept is considered to depend on four basic characteristics:

1. Size/self-sufficiency - Most new communities are situated on more than 800 hectares of land and house a minimum of 50,000 residents. At the same time, there is no consensus regarding optimal size, with suggestions as low as 20,000 and as high as 250,000 (Baranov, 1964; Clapp, 1971; Gallion and Eisner, 1963). It is generally agreed that the size of community must be appropriate to context and purpose, while large enough to facilitate a comprehensive ordering of land use. In terms of self-sufficiency, some suggest complete self-containment, including employment centers (O'Harrow, 1964), while others emphasize only that the community be capable of supporting complex public, commercial, recreational and institutional functions suitable to its intended purpose (Eichler and Kaplan, 1967).

2. Master plan - This is the tool that enables planners to promote a systematic ordering of land use. It is necessary - though not sufficient - to ensure that the intent for the new community is met. In combination with the other features of the new community concept, it becomes a potent tool (Clapp, 1971).
3. Single ownership and control - This is said to be the most important factor in ensuring that the provisions of the master plan are carried out (Clapp, 1971; Gallion and Eisner, 1980). As the direct link between planning and implementation it promotes continuity of purpose throughout the entire new community process. *Public* ownership and control is often said to offer the best assurance of all that high quality design will emerge (Pass, 1973).
4. Urban form - It is generally agreed that new communities should not only meet the technical requirements of comprehensive planning but should also reflect the application of modern and innovative planning and design concepts (Burby and Weiss, 1976). The U.S. Housing and Development Act of 1965 required all American new community proposals to demonstrate "significant use of advances in design and technology" and "desirable innovations in meeting social and economic problems" (cited in Stanland, 1972).

The case for planning at the new community scale is usually couched in terms of the problems it is intended to redress: urban sprawl, service inefficiencies, traffic chaos, incompatible land use patterns and social isolation. It is premised on the belief that good solutions to metropolitan growth problems are most likely when development is planned from start to finish. New towns are intended to provide good settings for full and happy lives (Osborn and Whittick, 1969).

7.2.2 The Concept of Neighborhood and the Neighborhood Unit

At the time of Mill Woods, the single most dominant feature in shaping the form of new town planning schemes was the neighborhood unit. This concept, originally formulated by Clarence Perry in the 1920s, stemmed from a belief that existing urban areas promoted an unhealthy social isolation that could best be combated by the organization of residential space into spatially defined neighborhood units containing all the necessary elements for healthy urban living:

> The neighborhood, which will have a limited area and a central meeting place will provide a setting for neighborly friendship and cooperative participation in common activities (Stein, 1957, p.219).

The neighborhood environment was to be safe for children, uncrowded so as to promote privacy and esteem, and infused with nature and openness (Perry, 1939; Stein, 1957). It was believed that, in breaking the urban environment into a series of distinct, inwardly focused cells, inhabitants would achieve the sense of identity and purpose necessary to overcome social isolation.

Perry's neighborhood unit concept, which owes its beginnings to the garden city tradition in Britain and the community center movement in the United States, specified the physical arrangement of dwellings, service facilities, roads and open space so as to promote both a sense of community and healthy family development. In the garden city tradition, it was based, first, on the principle of self-containment - that the area should embrace "all the public facilities and conditions required by the average family for its comfort and proper development within the vicinity of its dwelling" - and, second, on the principle of social interaction - "that the natural nest of the human family is not merely six solid walls, but this box plus a surrounding medium through which sunshine and air can penetrate and in which social activities of vital import to its members can be carried on" (Perry, 1939, pp.23

and 50). The elementary school, centrally located, became the social center for the entire community.

Perry's formula laid down six main principles (Figure 12):

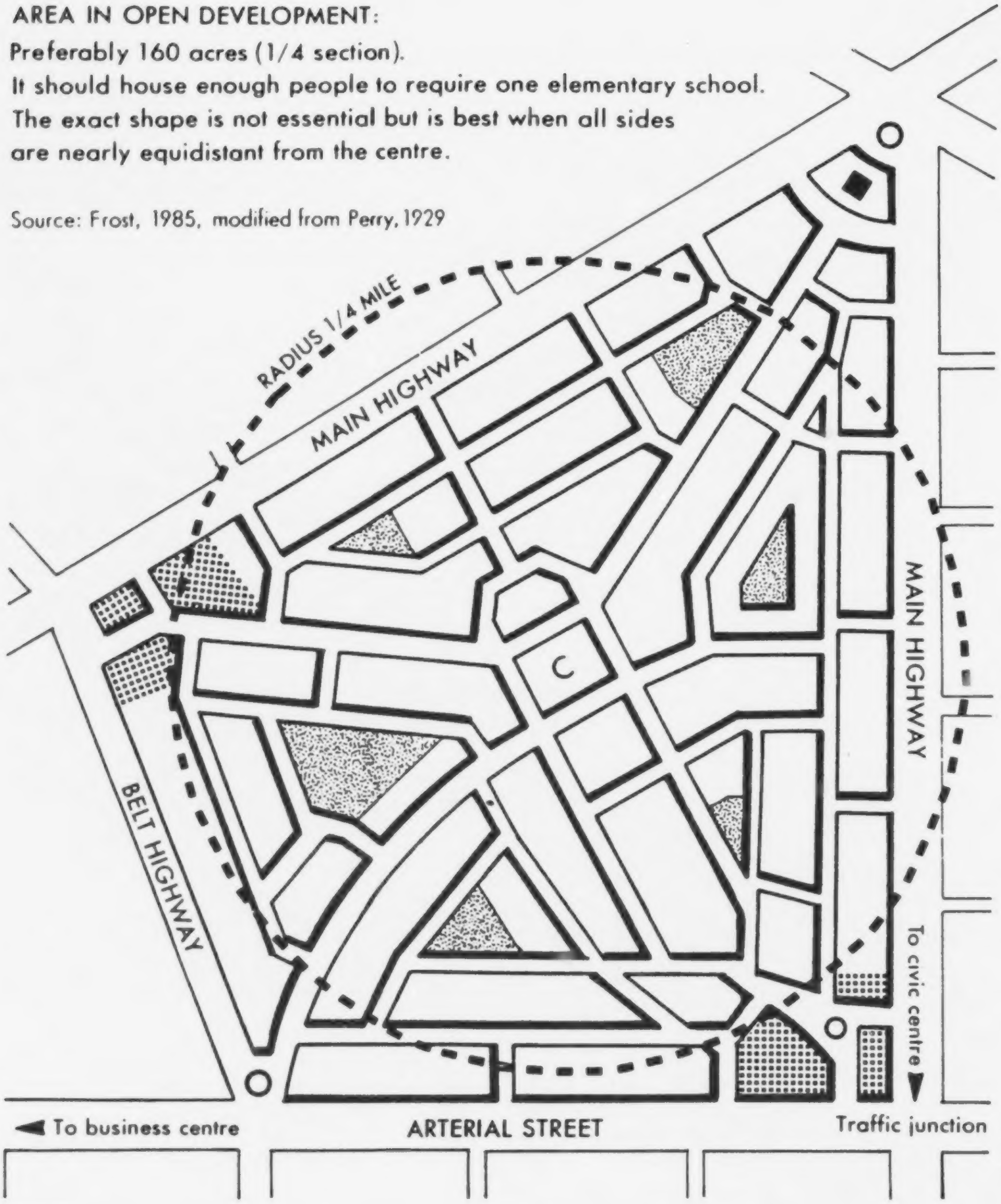
1. Size: The populated area that would require and support an elementary school.
2. Boundaries: The unit should be bounded on all sides by arterial streets of sufficient capacity to facilitate its by-passing and discourage penetration of through traffic.
3. Open Space: A system of small parks and recreation spaces to meet resident needs.
4. Institution Sites: Sites for the elementary school and other community facilities grouped at a central point or common.
5. Local Shops: Shopping districts relegated to the periphery, preferably at main intersections and adjacent to similar districts of adjoining neighborhoods.
6. Internal Street System: Designed to facilitate use of neighborhood facilities - schools, churches, parks, etc. while discouraging through access (Perry, 1939, p.51).

A population of approximately 5,000 was to be contained within a 0.4 kilometer radius of an elementary school, and the neighborhood unit was to have clearly defined boundaries, a community center and a curvilinear street pattern discouraging through traffic. Commercial facilities, buffered by apartments, were removed to peripheral sites, preferably at the major entry points or "portals". The population of the unit was intended to be homogeneous in terms of social class and income. The needs of the traditional nuclear family were paramount in determining the overall arrangement of physical space.

At the time of Mill Woods, fully 80 percent of the members of the American Planning Association advocated the neighborhood unit in practice (Gallion and Eisner, 1980). Documents considered to be most influential in guiding American planners and architects

AREA IN OPEN DEVELOPMENT:
Preferably 160 acres (1/4 section).
It should house enough people to require one elementary school.
The exact shape is not essential but is best when all sides
are nearly equidistant from the centre.

Source: Frost, 1985, modified from Perry, 1929


RADIUS 1/4 MILE
MAIN HIGHWAY
MAIN HIGHWAY
BELT HIGHWAY
C
To civic centre
◄ To business centre
ARTERIAL STREET
Traffic junction

▦ Shops and apartments. Shopping districts at the periphery and at traffic junctions, and preferably concentrated in form.

▨ Ten percent (10%) of the area is set aside for recreation and park space.

■ A shopping district might be substituted for religious site.

C Community centre. Only neighbourhood institutions.

Interior streets not wider than required for specific use and giving easy access to shops and community centre.

Figure 12: Neighborhood unit concept

promoted the neighborhood unit as "a strong force for the stability and development of individual and family life" (American Public Health Association, 1960). Similarly, in Canada, the technical planning literature gave unequivocal support to the neighborhood unit concept:

> A planned neighborhood is visualized as a geographic unit of between five and ten thousand people which supports its own educational, shopping, amusement and recreational facilities and social institutions. The design of a neighborhood should feature a local community center and, possibly, subcenters to which all buildings and streets within the unit are conveniently related. Besides providing a suitable physical form of residential living, the neighborhood is contemplated as a medium to promote the feeling of a community and a more or less coherent social life (Kostka, 1954, p.21).

Even in Europe, despite some variation in size (neighborhood units in Britain ranged in population from 5,000 to 12,000 and in Amsterdam and Poland to 20,000), neighborhood units were incorporated into the plans of most new towns (Merlin, 1971). Stevenage, England and Tapiola, Finland serve as examples (Appendix II).

Radburn, New Jersey, designed by Clarence Stein and Henry Wright lays claim as the first application of the type of "modern neighborhood conception" advocated by Perry. It is described here, rather than in the appendix, because many of its principles have achieved theoretical stature. It has made a lasting impression on the form of residential neighborhoods throughout the western world (Stein, 1957; Carver, 1962; Gallion and Eisner, 1980). The Radburn plan provided for a community of 25,000 people, organized into neighborhood units of between 7,500 and 10,000 people. In true Perry fashion, these neighborhoods were centered on an elementary school, and each was to have its own shopping center, but their physical form was altogether different and innovative. To answer the puzzle of "how to live with the automobile", Stein and Wright radically revised the conventional relationship between houses, open space and the circulation system within the local neighborhood, by employing the following elements:

1. Superblocks of 12 to 20 hectares allowing no through traffic, and a clustered arrangement of single and multiple family housing around large areas of open space.
2. Houses turned inward to face gardens and parkland, instead of streets, and grouped around cul-de-sacs.
3. Specialized roads (i.e. a hierarchy) that would allow traffic to move safely and efficiently with minimum impact on the community.
4. Separation of pedestrians and automobiles by means of a network of walkways removed from the roads and with grade separations (underpasses) at points of intersection.
5. Park as backbone of the neighborhood - large open areas in interiors of superblocks linked together as a continuous park system.

According to Birch (1980), although Radburn was never completed, due to the economic depression of the 1930s, the plan was "so well designed and rationally organized" that it has been an influential prototype for planners ever since.

7.2.3 The Circulation Hierarchy

According to Tripp (1944), road layout forms the "skeleton" of any town body. It sets the pattern of spatial relationships and exerts a powerful controlling influence over the entire community development (Tunnard and Pushkarev, 1963; Ritter, 1964; Gibberd, 1970; Barnett, 1982). In fact, determining a circulation system has been called the most important conceptual decision facing the new town planner (Llewelyn-Davies, 1966). Although not elaborated much thus far, Perry's neighborhood unit, the Radburn concept and most of the empirical examples in the appendix adopted a hierarchical arrangement of roads to ensure safety and unity at the neighborhood scale without compromising the overall accessibility of the whole community. The hierarchical principle, which makes use of cul-de-sacs, loops and curvilinear streets at the neighborhood level, is a conscious rejection of the rectilinear gridiron system as it was traditionally employed.[1] Tunnard and Pushkarev (1963, p.89) elaborate on its perceived shortcomings:

> The rectilinear plan does have its defects, particularly in residential areas. It conflicts with hilly terrain; it has difficulty accepting diagonals; it encourages through traffic, provides excess street capacity at low density while creating too many conflict points at intersections; and finally it becomes monotonous if overly large and undifferentiated.

In contrast, the hierarchical system endorses different design standards for different roads, depending on their intended traffic volumes and speed levels. The sole function of major arterials is to carry traffic to major points throughout the community in a fast and efficient manner. Collector roadways link to these arterials, generally forming the boundaries of neighborhoods and fed from minor local streets which service neighborhood activities but are designed to discourage through traffic (Tripp, 1944; Ritter, 1964; Gallion and Eisner, 1980). Where collector routes penetrate neighborhood boundaries - called through collectors - they do so with the aim of providing convenient access of residents to public transit services (Osborn and Whittick, 1969). Although the number of levels on the circulation hierarchy might vary depending on the size and arrangement of the town site, three levels are considered essential for the dual purposes of accessibility and safety:

1. Major arterials - to move traffic.
2. Collectors - to bring traffic from local streets to arterials.
3. Local neighborhood streets - to provide direct access to dwellings and service areas.

At all times, the hierarchy should be clear and comprehensible to its users. A street network in which all but the traffic engineer are easily lost provides no benefit over unplanned development (Lynch, 1962; Tunnard and Pushkarev, 1964; Gallion and Eisner, 1980).

7.2.4 The Residential Hierarchy

While the definition of road hierarchies can be linked to attempts to implement principles implicit in neighborhood unit-type planning, the stimulus for residential hierarchies came from a need to improve on these same organizational principles. At the time of Mill Woods, a veritable deluge of critical comment questioned the validity of the neighborhood unit on two fronts:

1. The adequate provision and spacing of services and amenities (Gans, 1961; Goss, 1961; Nicholson, 1961; Keller, 1968).
2. The promotion of social relationships and community identity (Willmott, 1962; Bunker, 1967; Sliddell, 1972).

In terms of the former, it was quickly recognized that the boundaries of the neighborhood unit did not contain a large enough population to meet the threshold for many of the services and amenities that were required by neighborhood dwellers, a fact hinted at by Perry himself. According to Carver (1962, p.60), "the population that supports one elementary school is not large enough to support the principal social and commercial services on which suburban life depends". As early as 1943, Engelhard presented an outline for the hierarchical arrangement of American residential areas in terms of the necessary enrollments for elementary, junior high and senior high school levels. In his scheme, two neighborhood units were organized around a junior high school and associated recreation facility, and four neighborhood units were linked together to support a senior high school and commercial center. Carver (1948) made a similar proposal for school servicing in Toronto, though calling for senior high schools that would serve larger catchment areas.

In the 1960s, the incorporation of the hierarchical concept into new community planning schemes was endorsed in several broad theoretical statements (Baranov, 1964; Gruen, 1964). By and large, however, they simply brought together what had already become accepted practice in real-world planning, as at Harlow, England and Vallingby, Sweden (see Appendix II). In terms of amenity provision, the most commonly recommended hierarchies contained three levels. The cellular organization endorsed by the United Nations Symposium on New Towns represents this trend in thought:

> There appears to be almost universal agreement among town planners that to ensure adequate comfort for the population, new towns... should be composed of repeating elements, consisting of groups of dwellings plus the community and cultural facilities in daily use... The first scale is the neighborhood. Experts have discussed their optimum size. These estimates range

> from 3,000 up to 20,000, with a norm around 6,000-12,000 ...
> The second scale of housing groupings is the residential sector formed by several neighborhoods. This includes those institutions, services and amenities that are visited by the public fairly frequently, but not necessarily daily: cinemas, clubs, health clinics, shopping centers... These residential sectors, whose population would normally range between 25,000 and 45,000 conveniently form the basic residential module for a town or city...
> The Symposium therefore recommends that these two scales of residential planning... should be used as repeating elements...
> The third scale of grouping of institutions is the town center, where administrative offices, business offices, major shopping, theatre, exhibitions, museums, etc. are located (Baranov, 1964, pp.284-286).

The principal motive for this form of hierarchical organization was efficient and effective service provision.

The second vein of criticism in the literature of the time stressed a social purpose for refining the planning approach to residential organization. A number of empirical studies, of which Wilmott's (1962) investigation of Stevenage, England is representative, indicated that the activity of "neighboring", or the forming of social bonds based on proximity, occurred at a scale smaller than that of conventional neighborhood units. The common response to their criticism was to include another level in the residential hierarchy:

> Can we not accept, therefore, that the street or housing group, where everyone may know everyone else, is also a form of neighborhood, and design accordingly? If we do so, then our larger neighborhood can be made up of a series of small ones of, say, between two to four hundred dwellings (Gibberd, 1967, p.263).

Housing groups were combined into neighborhoods, and neighborhoods into communities. The communities were then clustered around a town center which, in addition to providing high-level services, gave the town a focus for community identity. Harlow in England, Columbia, Maryland, and Don Mills and Erin Mills, Ontario are just a few of the new towns based on a hierarchical arrangement of residential units around a town center. Burby and Weiss (1976) called this the "flower pattern" of residential form.

7.2.5 Alternative Urban Forms

Stimuli for alternatives to the basic patterns described above came from a variety of sources, some context-specific to particular design exercises and some representing more general concerns about the traditional neighborhood approach. The strongest single vein of criticism was related to the ability of the neighborhood unit to capture a true sense of community. It questioned the validity of the entire concept of a community based on propinquity, emphasizing instead a community based on interest, which knows no physical bounds (Lynch, 1962; Webber, 1963; Keller, 1968).

In the main, and regardless of rationale, the alternative approaches addressed the problem of providing new town form through the route networks. Vallingby, Sweden and Runcorn, England are two cases where neighborhood organization was retained in combination with roadway systems that were more adapted to public transit than to private automobiles. In both cases, transport needs were the principal determinants of urban form. Still other alternatives, such as Cumbernauld, Scotland, Milton Keynes, England, Audubon, New York, Flower Mound, Texas and Shenandoah, Georgia, represent a conscious rejection of neighborhood principles and a corresponding emphasis on greater flexibility, in both a social and a physical sense, than was evident in traditional new town schemes. They followed from the argument that the complexity of urban social life was not adequately reflected in the neat branching hierarchies of typical planned developments (Lynch, 1962; Alexander, 1963). The neighborhood unit as a basic building block for the entire residential cell structure was derided for its oversimplification of real-world social interaction patterns and its preoccupation with the needs of young children and nuclear families (Goss, 1961; Lynch, 1962; Keller, 1968). According to the critics, a more appropriate planning unit would meet a broader range of human needs, allow more opportunity for freedom and choice in the use of facilities, and consider actual human activity patterns (Llewelyn-Davies, 1966; 1972).

7.2.6 Relationship to Mill Woods Case Study

The preceding information on new town design and residential planning provides a framework for understanding the context of planning ideas within which form decisions for Mill Woods were made. It confirms that distinctive form prototypes, though not numerous, did exist. Empirical examples in Appendix II reveal that within broad categories of form (linear, grid, flower pattern) significant variations emerge, demonstrating adaptations in response to specific contextual demands and different design objectives. In some cases, most notably Columbia, Tapiola and Milton Keynes, considerable effort was invested in the design process itself: to foster the identification of solid objectives for design, the involvement of a wide range of opinion and the deliberate exploration of different design options. In sum, though, despite optimistic pronouncements about new towns as modern-day utopias and the wide appeal of new communities as de novo experiments, designs from place to place show pronounced similarity in approach to physical form. Few physical or social design prototypes emerge as truly innovative responses.

7.3 The Background for the Mill Woods Project

> In the 1960s, there was a fear of shortage of product in serviced lots and the City was, frankly, running out of the areas that it had land holdings in. I don't think anyone looked down the telescope and said there will have to be a major change in the way land is developed and the City's role is going to change, but nonetheless, there was change on the horizon (Personal communication, Phil Ellwood, 15 May 1991).

It is impossible to achieve a full understanding of the Mill Woods plan generation process without having some appreciation of the factors, foreshadowed in Ellwood's comments, that came together to induce civic officials to undertake the massive land acquisition and development project that would ultimately become Mill Woods. In fact, as will become apparent, certain key events and particular elements in the political and administrative climate of the late 1960s had a profound shaping influence on the evolution of the Mill Woods planning exercise. And while it is not possible here to recreate the scene in toto, to conjure up the intensity of feeling, the excitement, the tension, the force of political pressure and the particular chemistry of the individuals involved, it is possible to gain some sense of the events that transpired and their impact on the subsequent planning of Mill Woods.

First of all, it is important to know that even before the Mill Woods project, the City of Edmonton played a prominent role in the land development (Dale, 1969; Le Bourgeois, 1981; Personal communication, Phil Ellwood, 1991). This came about through no conscious effort on the part of civic officials. As a result of the downturn in the Western Canadian economy after 1912, the City took possession of a large amount of land forfeited by owners who failed to pay their taxes (Dale, 1969; Bettison, Kenward and Taylor, 1975; Smith, 1990). Most of this land was situated on what was, in 1950, the fringe of the city, in areas of prime potential for future development. It had also been indiscriminately subdivided during the land boom of 1908-1912, but not in a form suitable for the type of orderly suburban development envisioned by city planners in the 1950s.[2] As a significant landowner in these areas, the City had a vested interest in ensuring that acceptable development did occur. To this end, starting in the 1950s, civic officials took advantage of provincial planning legislation to enter into replotting schemes with individual land owners in the fringe locations. These replotting schemes involved three steps:

1. Canceling an existing subdivision, or consolidating any parcels of land in a subdivision into one area of land.
2. Making a new subdivision that would be registered in place of the canceled or consolidated subdivision.
3. Redistributing the newly subdivided land among the individual land owners affected by the scheme (Alberta, 1980, p.25).

The end result of replotting was a redistribution of lots, with each land owner achieving the same proportion of land in the new subdivision and a more efficient and aesthetic arrangement of residential land uses in the subdivision as a whole. In addition, to facilitate the development of its landholdings, the City became involved in providing the physical service infrastructure that was necessary for such development to occur. The end result was that the City became recognized as a significant supplier of lots and services to the housing industry. Concomitantly, the civic administration developed a strong core of expertise in three areas related to that role:

1. Land negotiation and marketing
2. Land use planning and neighborhood design
3. Physical service provision

This expertise would play a key role in the City's ability to undertake the Mill Woods Project.

By the 1960s, when the City's own lot supply had dwindled, civic officials were under pressure. Their ability to act as developers was diminishing at a time when the public at large was becoming increasingly concerned about the cost of housing and land. As a consequence, according to Ellwood, there was a new awareness in the civic administration of the political importance of the land supplier role:

> We have a political environment which says that we're very concerned about the lot shortages and the builders are all haranguing the City because the City has always supplied lots. And the City hasn't stood back and said look fellas we only got into this accidentally so don't look at us. There was no conscious step back or an objective look at what the City should be doing as a government in terms of facilitating lot supply... So there was tremendous amount of political and administrative pressure to come up with

> some sort of answer to the dilemma (Personal communication, Phil Ellwood, 15 May 1991).

The City was expected to respond, in some manner, to the perceived crisis in land supply and housing costs.

But why did the response take the form of Mill Woods, a massive residential community in the far southeastern corner of Edmonton on land designated for other uses?[3] Here, a number of other situational factors come into play. First, it had become apparent, within the civic administration, that the most significant servicing cost for new development was no longer pipes and sewers, but the construction of transportation corridors to reach the far-flung suburban sites. Edmonton's transportation policy at the time was based upon the Metropolitan Edmonton Transportation Study, completed by the Edmonton District Planning Commission in 1963. METS, as it has come to be called, designated a series of freeways to service the city of Edmonton and surrounding area. One of them, the Mill Creek Freeway, was to link Edmonton's downtown to its southern zones, with the ultimate aim of providing fast and efficient transportation connections for the residents of the southwestern suburbs[4] (E.D.P.C. 1963; Bettison, Kenward and Taylor, 1975). An unanticipated side benefit, however, was the opportunity it created with respect to the then-vacant land that would eventually become Mill Woods (Figure 10). The following excerpt from the interview with Phil Ellwood relates the transportation element directly to the decision to investigate the potential of the southeastern area for residential expansion. He was the first to see possibilities in the area for anything other than the industrial and agricultural uses for which it was reserved in planning documents of the day:

> So we were going to fire this brand-spanking new facility, operating at 60 miles an hour, out along Mill Creek to 45th Avenue and 91st Street, and then west so that over the next few years the area in the south-west could grow like mad... But in the meantime, the freeway would be going past vacant fields because in the south-east there was nothing. So, realistically you say to yourself, if the transportation element is the most important thing then it is obvious we want to capitalize on it in the south-east as soon as we possibly can. Otherwise, a landowner or, that dreadful word, "speculator" could acquire the land and take advantage of the facility first... I said, there isn't a chance that that land is going to sit vacant, colored dark blue for industrial expansion. Someone else is going to go in there and grab it. Why not us? It was at that time that I began thinking of the south-east part of the city as residential growth area (Personal communication, Phil Ellwood, 15 May 1991).

This was in 1968, at which point the actual planning and development wheels were still a long way from being set in motion.

After doing a thorough site assessment of the southeastern area, Ellwood and Clive Rodgers, the superintendent of the planning department and the only other person aware of the preliminary interest in the site, sent a handwritten letter to the City's Chief Commissioner, Peter Bargen, and the Commissioner of Public Works, D.B. Menzies. They suggested that the southeastern zone had the potential to solve the problem of lot supply and housing in the city.[5] But although their idea was greeted with much enthusiasm by the Commission Board and the then-mayor, Ivor Dent, there was considerable doubt that the City would be able to acquire ownership of the land without arousing speculative interest and a concomitant jump in land prices. Because most of the proposed southeastern development area (or SEDA as it was called until 1970) lay outside Edmonton's boundaries, the City could not acquire the land without prior notification to the County of Strathcona, as the municipality in which the land was located.[6] Such a public disclosure of the City's intentions would almost certainly have led to speculative buying. Then, in 1969 the provincial government showed an active interest in Edmonton's housing difficulties.[7] On 11 July 1969, the Minister of Municipal Affairs sent a letter to Mayor Dent offering to participate in the City's south-east land assembly program. Since the provincial government was not required to disclose its intention of buying land, the likelihood of speculation was diminished. Under the agreement subsequently signed between the two governments, the Province agreed to acquire land within SEDA with the ultimate aim of selling it all to the City of Edmonton.[8] This marked the formal beginning of the South East Development Project. During August and September of 1969, the Alberta Government, acting through its agency, the Alberta Housing Corporation, secured 1,790 hectares of the 2,630 hectare site.

The involvement of the provincial government in the land acquisition phase of Mill Woods carried with it certain stipulations regarding the area's development.[9] Under the memorandum of agreement between the City of Edmonton and Alberta Housing Corporation (29 June 1970), two principal objectives were advanced:

a. the maintenance of a continuous and adequate supply of land for housing so that the trends to spiraling costs, particularly for land, may be reversed; and
b. the progressive servicing and development of land in the area within the framework of The Alberta Housing Act 1968, The National Housing Act and The Planning

> Act (each as amended) to provide public and private housing of good quality at minimum cost.

With regard to the second objective, it was agreed that development would provide "for public housing and housing for low income families" and that the City would provide for "at least five (5) percent of the ultimate population of the area within subsidized projects". It was further stipulated that "an outline plan for the whole area, to be prepared by the City, shall be submitted to the [Alberta Housing] Corporation for approval". Thus the sole responsibility for planning Mill Woods, other than submitting the outline plan to provincial authorities for approval, fell to the City of Edmonton. And although not part of the agreement signed between the two parties, it was generally understood that the City would endeavor to plan and develop Mill Woods as expeditiously as possible so that the first homes would be ready for occupancy in the fall of 1971.[10] Planners certainly worked on the assumption that this was a hard and fast deadline (Personal communication, Dave McCullagh, 3 March 1989).

7.4 The Generation of Alternatives Stage

7.4.1 Trajectory of Events

In keeping with recommendations by its own planning department, City Council invited outside planning consultants to submit tenders for the preparation of the SEDA outline plan. According to an internal planning department discussion paper, prepared in January 1970, it was generally assumed "that the bulk of the design work would be completed by planning consultants with the

Planning department to assume a supervisory role, in addition to supplying basic research material". To this end, in December 1969 the Planning Department began assembling essential site and background data. On 22 December 1969, the Commission Board tabled the following recommendation to Council:

> That the Commission Board be authorized to complete negotiations with the firm of Project Planning Associates... In order to ensure the earliest completion of competent and comprehensive plans for the South East Development Area so that development can take place in the fall of 1971, and in view of the fact that the City Planning Department does not have time or staff to undertake this project , it has been found necessary to engage a firm of planning consultants (Commission Board Report No.29, 22 December 1969).

However, on 16 April 1970, City Council vetoed this recommendation and passed the following resolution:

> That we instruct the Planning Department to appoint a team from amongst its own resources to undertake and complete the plan and to obtain consulting assistance from within the Edmonton area, as necessary, to complete the plan (City Council minutes, 16 April 1970).

According to Ellwood, Council took this direction because intense lobbying from competing consultants, eager to secure the lucrative contract, made a politically safe choice impossible:

> The Council asked Clive Rodgers and me if it [the outline plan] could not be done in house... Feeling the political mood and understanding the need for a solution to a very difficult problem of how to bail Council out on its dilemma of choices over who should do the work, we said it wasn't our intention, but we supposed we could pull a team together. With that as a basis, Council passed their motion lickety-split and were off the hook of having to make choices between competing professionals (Personal communication, Phil Ellwood, 15 May 1991).

Within a week of that decision, the Mill Woods Project Team, comprised of four planners and a draftsman (Appendix I), had begun work on the Mill Woods Development Concept Report. Three weeks later they had produced preliminary sketches - an embryonic image - of the outline plan. And although this image did evolve and was adapted somewhat over the course of the next eight months, it bore striking similarity to the final form embodied in the *Mill Woods Development Concept Report*, as adopted by City Council on 7 June 1971.[11]

7.4.2 The Mill Woods Development Concept Report

At this point, it is necessary to bypass the intervening eight months to present the substance of the outline plan, as detailed in the Development Concept Report. This will enable the reader to better understand the nature of generation activity when it is discussed later.

The development concept for Mill Woods described a residential "new community" which was intended to house more than 120,000 people.[12] The outline plan was advanced as "an orderly scheme of unrivaled quality" and "a showpiece of new urban growth". It had two fundamental goals:

> 1. To reduce the price of housing generally [in Edmonton] through land marketing and servicing programs.
> 2. To upgrade the quality of residential environment respecting the social, physical and economical (sic) needs of the residents (Edmonton, 1971, unpaged).

The first goal was to be realized primarily through marketing strategies, whereas the second related more specifically to the principal development objectives advanced within the document:

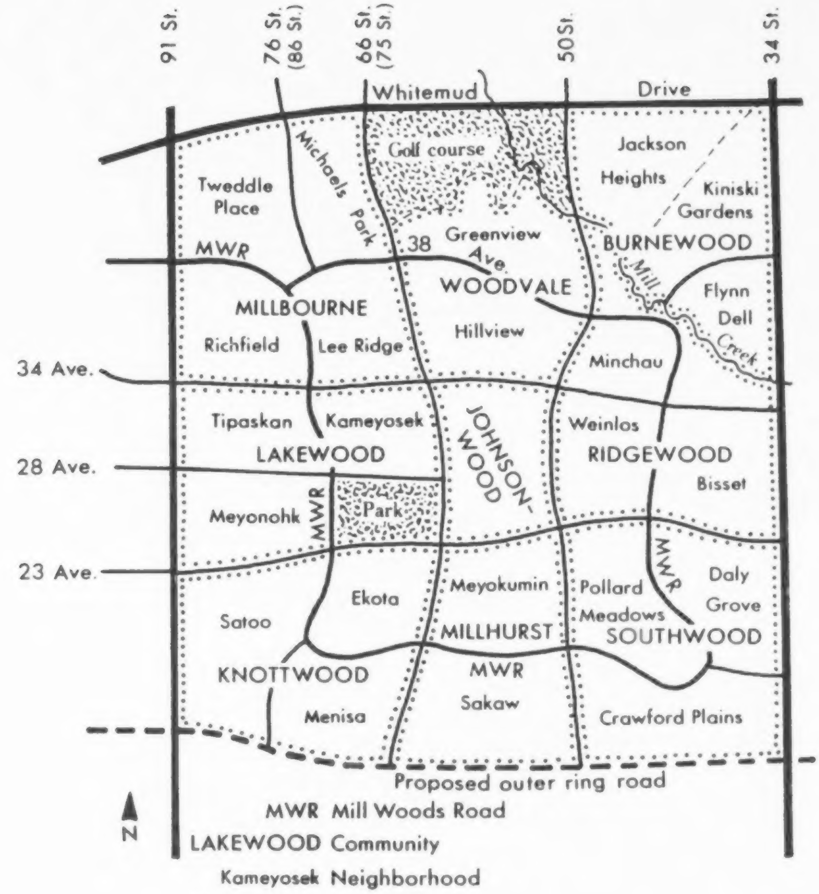
> * To obtain an overlapping system of community structures based upon the economical provision and maximum use of community facilities and the fostering of community participation and development.
> * To focus the community on to an intensively developed central core incorporating the major social, cultural

and economic elements, serving as the main forum for community interaction.

- To structure the community by relating circulation systems and land use patterns to effectively serve the various needs of the residents in a safe and economical manner.
- To achieve a community population representing city-wide demographic characteristics through the provision of a broad range of dwelling types and tenures.
- To preserve a sense of human scale and establish community identity - in the process creating a wide range of urban experiences.
- To allow the expansion of the new community on an orderly and sequential basis, meeting sound economic, social and physical objectives.
- To maximize the open space potential within the Mill Woods community to provide a high level of residential environment (Edmonton, 1971, unpaged).

To these ends, the outline plan was based on a traditional hierarchical ordering of residential space, beginning with the individual dwelling unit and moving upwards to house groupings, neighborhoods, communities[13], districts and finally to the Mill Woods "new town" (Figures 13 and 14). The stated intent behind the structure was to permit economical service provision and functional efficiency, although two key elements in the hierarchy, the neighborhood and the community, were also advanced with the social aims of promoting sense of place and identity amongst residents and fostering interaction among individuals and groups.

At the community tier of the hierarchy, Mill Woods was to be organized into nine units - eight residential communities plus the town center (Johnsonwood) - each with different character and identity and focused on a community center consisting of grouped service facilities and/or a secondary or junior high school (Figure 14). The centers were to serve the 12,000-20,000 persons of the community (the population of each community varied accord-


91 St.
76 St.
(86 St.)
66 St.
(75 St.)
50 St.
34 St.
Whitemud
Drive
Golf course
Jackson
Heights
Kiniski
Gardens
Tweddle
Place
Michaels Park
38
Greenview
Ave.
BURNEWOOD
MWR
Mill
Creek
Flynn
Dell
WOODVALE
MILLBOURNE
Hillview
Richfield
Lee Ridge
Minchau
34 Ave.
Tipaskan
Kameyosek
JOHNSON-
WOOD
Weinlos
LAKEWOOD
RIDGEWOOD
28 Ave.
Bisset
Meyonohk
MWR
Park
MWR
23 Ave.
Daly
Grove
Meyokumin
Pollard
Meadows
Ekota
Satoo
MILLHURST
SOUTHWOOD
KNOTTWOOD
MWR
Sakaw
Menisa
Crawford Plains
Proposed outer ring road
N
MWR Mill Woods Road
LAKEWOOD Community
Kameyosek Neighborhood

Source: Edmonton, 1989

Figure 13: Community and neighborhood structure of Mill Woods

MILLWOODS DEVELOPMENT AREA consists of nine communities, three of which are oriented toward a main transportation corridor. A comprehensive central core, including a major shopping complex will serve the needs of Mill Woods and function as a community forum.

A COMMUNITY consists of three or four neighborhoods encompassing a resident population of between 12,000 and 20,000 persons focusing on a community centre related with Junior High School facilities and served by efficient and convenient transportation systems.

A NEIGHBORHOOD consists of a number of relatively independent residential units, each comprised of two or more housing units, with an approximate total population in the vicinity of 5,000 persons.

HOUSING UNITS clustered around public transportation stops and small parks connected by walkways to major neighborhood services such as schools and shops.

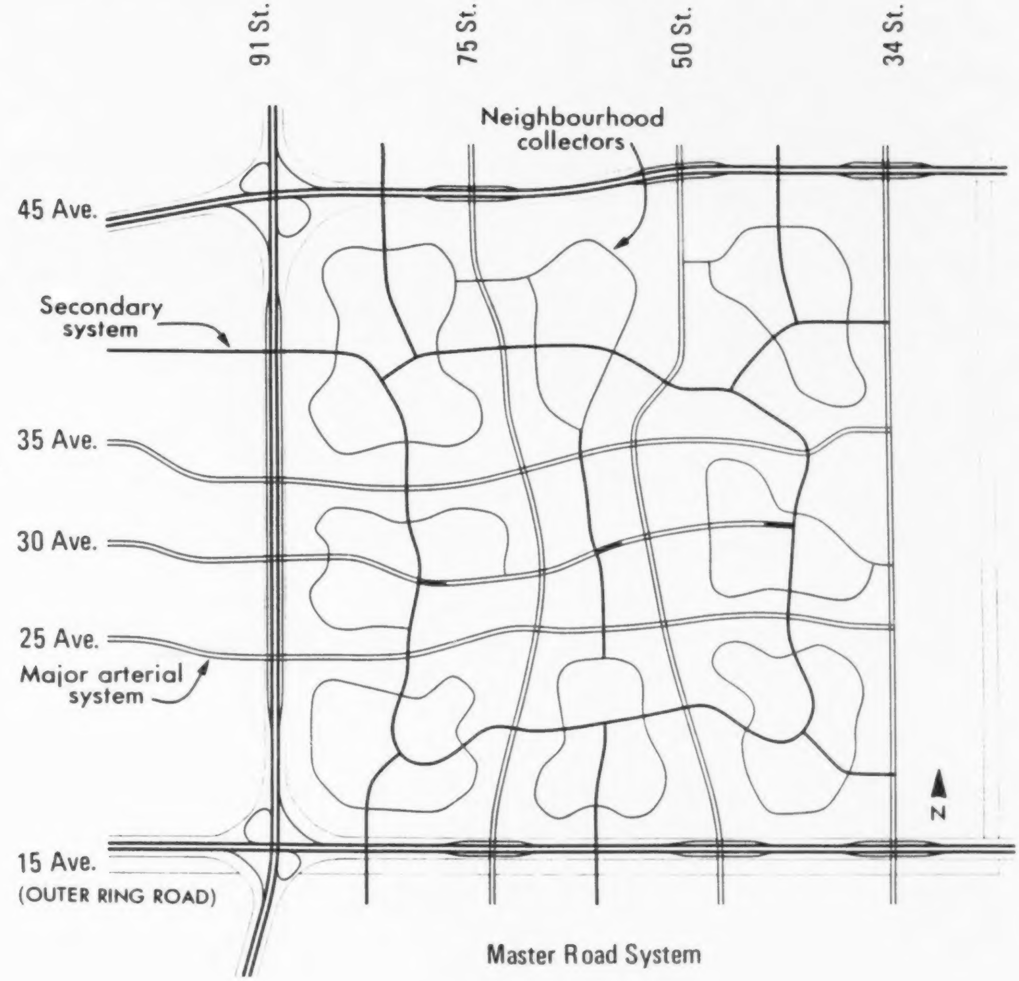
Source: Edmonton, 1971

Figure 14: Residential hierarchy: Mill Woods

ing to specific site factors) and were located so as to provide maximum accessibility by car, bus and pedestrian walkway. The communities were to consist of three or four neighborhood units containing 4,500-5,500 people each. The structure was determined by school servicing requirements at the junior high level and the positioning of the arterial road network. The neighborhood units, which have been used as a basic residential building block in Edmonton since 1949 (Harasym, 1975), were designed to promote accessibility of young children to elementary school sites. According to Edmonton Public School Board standards at the time, "no child should be required to travel more than 1/2 mile to reach an elementary school".[14] Neighborhood services, consisting of basic educational, recreational and community league facilities and a convenience store, were located so as to be easily accessible to "housewives and small children, who are generally without means of private transportation".

While the community and neighborhood levels of the hierarchy are the only ones apparent from the map of the development concept, reinforced as they were by a hierarchical system of roads designed specifically to emphasize these two divisions, a district level of service was assigned as well. It determined the provision of high school educational facilities and major recreation and park projects. Each of the two districts was to service a population of 50,000-60,000 residents and was comprised of four community units. Finally, to bring the whole of Mill Woods together as a unit, a town center was located in the geographic center of the development site. This central core was designed to house major educational, commercial, cultural and social facilities, such as a library, community college, regional shopping mall and hospital, as well as high-density residential development. It was to act as the hub for the entire project, with "special features warranted to emphasize community [i.e. Mill Woods] identity and enhance its environmental quality" (Edmonton, 1971, unpaged).

The hierarchical system of roads embodied in the plan was designed to reinforce the residential structure (Figure 15). Major arterials, spaced along a 1/2 mile grid, were intended to provide rapid access to key points outside the Mill Woods site. They also divided the site into the nine major units referred to in the plan as communities. The arterial grid was overlaid by a secondary system, which linked the eight residential communities together along a "circle" route (i.e. Mill Woods Road, Figure 13) so as "to encourage inter-community travel and in a sense tie the Mill Woods community together" (Edmonton, 1971, unpaged). It was also intended to serve, at some point in the future, as an express route for buses feeding into a rail transit corridor along the major arterial route on 28th Avenue. The secondary system was mirrored at a lower level by neighborhood collectors. These were to unite neighborhoods within each community in terms of social identity, while facilitating efficient public transit in accordance with Edmonton Transit policy of the day. These "internal collector loops", as they were called by Edmonton Transit officials, were meant to ensure that "90% of the population in a neighborhood be located within 1,300 feet of a bus stop", and that


91 St.
75 St.
50 St.
34 St.
Neighbourhood collectors
45 Ave.
Secondary system
35 Ave.
30 Ave.
25 Ave.
Major arterial system
N
15 Ave.
(OUTER RING ROAD)
Master Road System

Source: Millwoods, City of Edmonton Planning department, 1971

Figure 15: Circulation hierarchy: Mill Woods

bus routes "be as straight as possible with a minimum of left and right turns" (Correspondence, J. Krooner, Transportation Planning Engineer, 10 May 1970).[15] In addition, it was expected that no rider would be forced to transfer more than once to reach the downtown core and that "every child should be able to reach his elementary or junior high school without changing buses at all". It should be pointed out, however, that while the neighborhood collectors, functioning as *intra*-community loops, met Edmonton Transit needs in the 1960s, the secondary system, functioning as an *inter*-community loop, did not:

> After departmental discussion on the functioning of the inter-community loop or ring route within Mill Woods it was decided that with the efficient operation of the community loops the ring route would be redundant and considered unnecessary (Memorandum from K. Dmytryshyn, Edmonton Transit System, 2 July 1970).

Nonetheless, City planners still foresaw a role for the secondary system as part of the rapid transit component of the plan, and so elected to leave it in.

Other elements in the circulation system were local streets, to provide intra-neighborhood access and to be planned at the detailed subdivision design stage, and pedestrian walkways to provide easy access to key neighborhood and community activity points. In summary, each of the residential neighborhoods was bounded by arterial and/or secondary system roadways and bisected by an inter-neighborhood collector route. Interior roads were to follow curvilinear and keyhole patterns (Edmonton, 1989). At that level, the circulation hierarchy showed the influence of Radburn planning principles.

Finally, the concept report stressed a number of other residential environment objectives with important ramifications for physical form. First and foremost, the plan called for a wide range of dwelling types and tenures, embracing all forms of multiple and single-family dwellings, for both renter and owner occupancy, from low to high income. To this end, the plan recognized the commitment of the City to provide varied densities, and sufficient subsidized housing to accommodate 5% of the total population, along with the need to develop experimental and innovative housing projects to allow "the greatest possible number of residents of varying economic capability to enjoy adequate accommodation and home ownership". Again reminiscent of Radburn, the plan also emphasized the "continuous and imaginative use of open space" to provide a broad range of park and recreational opportunities and to serve as a critical element in the design and location of multiple dwelling sites. Overall, the concept was advanced to reinforce the major physical form objective of the Mill Woods project:

> That it will be a place for people, a community with a sense of place where the physical environment will be realized in the context of human scale (Edmonton, 1971, unpaged).

7.4.3 **Number of Alternatives**

> The concept plan was an honest effort to try to convey the approach we wanted to follow in Mill Woods. What is missing from the plan is the chemistry - the trials and tribulations of working our way through what was usually a fairly complex and complicated process (Personal communication, Dave McCullagh, 21 June 1989).

While the concept report reveals the outcome of the generation process and gives some indication of the degree of search and design, at least as embodied in the chosen form, it says nothing about the process leading up to that choice. Yet it is this process - the political and administrative climate, the site constraints, the interaction of members on the Project Team, and the impact of all of these factors on generation activity - that holds the key to understanding how and why that choice was made. To understand the generation of Mill Woods form, then, it is necessary to unravel this process.

The Concept Report indicates that the planners followed a systematic and rational process in their quest for a showpiece of new urban development. The report tells us that a part of this process was the "preparation of alternatives" and "the application of all constraints and planning parameters in the testing" of these solution forms. But while these statements are impressive from a theoretical standpoint, they appear to bear little relation to the generation activity that was actually carried out. Piecing together information from the documentary records, the 1970 seminar tapes and the personal interviews with the participants, it appears that no real attempt was made to construct concepts other than the one that was ultimately adopted by City Council. When asked directly about their generation activity, none of the interview subjects recalled preparing alternative solution forms:

> As far as the outline plan stage - there was just one. It came together more or less on the basis of all the requirements. It just fell into place.
>
> The decision, and I remember this quite clearly, was to present just one plan - for practical reasons.

> I remember that I wanted to evolve a system of models which would set up alternative configurations for density and open space. But looking at it from the point of what we felt was politically feasible, we couldn't do it... I guess ideas were kicked around by the team in terms of group debate and critiques but in terms of any sophisticated alternative development, that wasn't done. It would have been too complex.
>
> We wanted to go with what our best thought was at the time. If you tell a planner to do options, he will plan until hell freezes over without ever actually committing to anything... We couldn't afford the luxury.
> (Personal communications, 1989-1991)

Thus, the professed process, as stated in the outline plan, was largely a myth, at least in the sense of formal and explicit alternative development. Yet, the fact that the plan's authors laid claim to such a procedure, even in its absence, suggests that they were aware that their methods contravened accepted standards for effective practice at the time. Nonetheless, they found themselves unable - or unwilling - to construct the type of generation activity that they wanted to take credit for.

From documentary and interview sources, three clear reasons emerge for the failure to develop alternatives. First, given the intense political pressure to have land ready for occupancy in the fall of 1971, planners were under severe time constraints:

> We were forced into moving quickly. Every planning process has pressure in terms of dates and deadlines but the Mill Woods project had it in spades. Politicians wanted to see progress right now. They were making large monetary expenditures and they were very anxious to have the plan complete... Time was the principal constraint on us. We knew certain deadlines were essential to get things on the ground.
>
> I can't begin to tell you the pressure we were under to do it fast and to do it right. They [the politicians] were told we could do it faster and bet-

> ter than outside consultants. They wanted to see results right away.
>
> Council was concerned about going in to this venture, spending major bucks up front. With all that nervousness we had to move very quickly and very efficiently... And the worst thing you can do to a planner is to say here is a blank piece of paper, draw me a plan... If you don't give him a lot of fixed deadlines and parameters he can't even sharpen his pencil... What we needed to have done was a plan that would work and would let us get going to meet the municipal objective which was to supply serviced lots for housing.
> (Personal communications, 1989-1991)

In other words, the professed aim of planning a new community of the highest order had to yield to the economic landbanking goals, which were concerned with providing an immediate panacea to high housing costs. As Dave McCullagh advised the project team and consultants at the seminar sessions in 1970, "We have a problem of time. I don't think we are afforded the opportunity of some of the refinement in process and plan ideas that would be desirable given the scope of the planning problem". Again, on 1 October 1970, Dr. Bargen, the City's Chief Commissioner, advised the planners that it was their responsibility to prepare and present *one* concept for the administration and politicians to assess. Time was of the essence, he told them: "*You* design the process, *you* give us the concept and *you* demand the resources". The planners were even directed to circumvent normal channels "if necessary", to ensure that the City's commitment to an enhanced land supply could be met (Minutes of a meeting between Dr. Bargen and Mill Woods Project Team, 1 October 1970).

In light of this evidence, it cannot be disputed that the generation process was vitally affected by time constraints, but they were not the only factors in play. In addition, planners' uncertainty about political motives left them unwilling to leave the choice process entirely to their political masters. They were concerned that sound residential planning objectives would be cast aside out of political expediency. Some of the Mill Woods Project Team were decidedly mistrustful of the integrity and judgment of civic politicians. The following excerpts from the July 1970 sessions demonstrate this point:

> It is important to recognize that we as planners will probably be faced with strong political pressures to look at SEDA as an immediate cure to short term ills, such as provision of low cost or public housing sites. We have a few eager aldermen who are beating the drum loudly in this direction, with no consideration for long term quality of life and urban design philosophies... We are walking a tight rope between political pressure by the government to jam in massive public housing projects and acceptable planning and marketing procedures. They want immediate solutions and immediate means, before the next election.
>
> I share the concern about where the decisions will actually be made on this. We may be in a real problem with our politicians wanting to adopt a short-range economic approach... If you made these comments to probably any alderman sitting on council right now they'd say, "Yes, I agree [with the concerns]". But those are the ones who give us all the bloody trouble when it comes to the crunch (Seminar tapes, July 1970).

Given these sentiments, planners went with a single plan approach in the interest of securing their one golden opportunity to produce a high-quality residential environment. Reflecting back, two of the planners still expressed concern about the politicians' ability to evaluate and select good urban form:

> The practicality was that if we presented council with a whole bunch of designs to pick from you were going to have a hell of a mess... With a complicated process like Mill Woods, they were incapable of making a choice because they didn't know all of the

> implications... I know that's an arrogant point of view but its true.
>
> If I provide three or four alternatives, who am I going to ask to make the judgment on them? The politicians? I don't think they're qualified to do it. Very few planners are, never mind the politicians. Besides, Council had already gone through the agony of not being able to decide what consultant to appoint so to give them three alternatives and say pick the one you like best, and by the way we've shaded that one gray because we don't like it much, was a bloody waste of time... I'm telling you, I could have gone to Council with a dozen alternatives and had them approve the one I wanted them to approve. But why bother? We didn't buy this land as a planning exercise.
> (Personal communications, 1989-1991)

Planners thus believed that they were in the best position to select the form concept for Mill Woods. Moreover, they saw this as part and parcel of their status as objective land use experts. Two of the planners also suggested that giving Council alternatives to choose from would only have confused the larger planning process, guaranteeing delays in meeting target deadlines. They believed that politicians would have been unable or unwilling to express firm commitment to a preferred option quickly enough to meet land banking and economic objectives. Overall, this second reason for not formally generating alternatives underscores a basic conflict within the Mill Woods project between what one planner called "pragmatic, bread and butter concerns" and "longer horizon, good urban design philosophy". This conflict will be touched on again as discussion of the generation process unfolds. Suffice it to say, at this point, that planners were firmly convinced that sound residential design was a subsidiary concern for their political bosses.

A third possible explanation for the failure to generate formal alternatives emerged from the interviews. It was not the sentiment of the entire project team, nor of the team leader, Dave McCullagh, but two of the interview subjects suggested that, given the specific site constraints of any development project, like Mill Woods, there can be only one truly "best" and obvious form for the solution to take:

> I don't believe in planning theory for alternatives. When you enter a design process, there is only one right solution for that spot. You get a gut feeling. All of the site constraints, etcetera bring it down to only one choice... If you take 100 planners and set them down on the Mill Woods project and if you give them time to go through the testing process they would all still come up with very, very similar things. There is always only one solution possible.
>
> I'm a great believer, despite what many planners will tell you, in the organicism of the plan. Much of it is dictated by the constraints. That was certainly true of Mill Woods (Personal communications, 1989-1991).

These beliefs are not without support in urban design literature, where some authors likewise conceive an almost deterministic relationship between site and solution form (Spence-Sales, 1981). At the same time, it is worth noting that the participant who described the "organicism of the plan" now believes the town center in Mill Woods to be wrongly placed, and four other participants find the circulation hierarchy confusing "on the ground".

Leaving aside, for the moment, the implications of these criticisms of the developed form, Mill Woods did have a number of site constraints that had to be acknowledged by the Project Team. First, and perhaps foremost, the site was traversed by four major pipeline corridors containing no fewer than 23 oil and gas transmission lines. According to Alberta Subdivision and Transfer Regulations of the time, no building was permitted to be closer than 50 feet from these gas and hydrocarbon pipelines.[16] This meant that pipeline rights-of-way had to be left as open space in the outline plan. Second, an eighty-acre sanitary landfill was located in the north-east quadrant of the site. It was to be phased out of operation, some two to five years after the commencement of building in Mill Woods, but it was anticipated that soil stability problems would make it a dubious location for future residential use. Third, the Mill Woods site also contained a number of aerial transmission lines, owned by Calgary Power and located in a pair of wide rights-of-way in the westerly quadrants of the planning zone. In 1970, civic officials began negotiations with Calgary Power to relocate these power lines to a proposed utility corridor on the south side of the proposed outer ring road at 15th Avenue (Figure 15). This transaction was not complete when planners prepared the concept report. Calgary Power had indicated its willingness to cooperate by then (Minutes of the first meeting between the City of Edmonton and Calgary Power, 24 March 1970), but the actual relocation could not be completed before residential construction began in 1971.

Finally, and of importance to the design of the circulation hierarchy for Mill Woods, the major arterial road system within the site was dictated in large part by pre-existing and planned arterial routes that would connect the site with the rest of the city. These external access routes imposed the major arterial grid network illustrated in Figure 15.

Otherwise, there were no significant physical constraints on development. The site was comprised of gently rolling farm land with two major points of topographical elevation. Drainage was judged to be adequate throughout, although it was acknowledged that farmers in the central and westerly zones had experienced flooding problems in periods of heavy rainfall and spring run-off. The site was largely devoid of tree cover with the exception of scattered small stands of poplar, aspen and white spruce, and the Mill Creek Ravine in the northeastern quadrant, which contained extensive and varied vegetation and "exciting topographical relief". In McCullagh's words (July 1989), "It was never believed that the physical site would be a real constraining influence on the SEDA design".

The physical site tells only part of the story, however. Elements in the political, economic and social environment also play an important role in setting the stage for any physical plan and the Mill Woods project was no exception. In fact, in exploring contextual facets of the process one begins to see that the planners' golden opportunity was not so golden after all. The "blank slate" upon which they were to build "a first class community in terms of all things planners should hold dear" (Phil Ellwood, July 1970) was far from blank. And although the relationship between contextual factors and the form of the plan was not as deterministic as suggested by the two planners cited above, neither did the project team perceive itself to be free to employ "the most advanced planning techniques" so extravagantly claimed in the foreword to the *Mill Woods Development Concept Report*.

7.4.4 Generation Activity: Search and Design

Contextual factors can be understood in terms of the practical difficulties that befell planners during generation activity, constraining both the nature of that activity and the substance of the plan that was produced. At the outset of the discussion of these difficulties, though, it is necessary to expand on a point made earlier, when it was suggested that the plan was derived almost in embryonic totality some three weeks into the plan preparation exercise. That is, on first glance it appears as though the planners employed a conjecture-analytic approach by proposing a solution image on the basis of a few cues in the environment, and then subjecting that image to serious analysis and refinement after the fact. In fact, the project team's start date of 21 April 1970 is an artificial measure of the generation process, since it disregards four months of prior work undertaken by the planning department on the assumption that they would be expected to provide extensive background information to the consultants, once they were engaged. In December 1969, a departmental discussion paper directed planners to gather information on the following matters:

1. Base maps of the site, aerial photography.
2. Survey of existing land use in study area and adjacent industrial zones.
3. Preliminary roadway design research into the capacity of roads leading to the area and the Mill Creek Freeway.
4. Study of pipelines re: relocation, expansion.
   Study of aerial transmission lines re: relocation.

5. Possibility of discontinuing land fill site.
6. Establishment of basic policies on the use of land in the south east area. Although the consultants would probably undertake some analysis in this regard the following might best be answered by the City:
    a. The number, type and location of public housing and other publicly subsidized housing units.
    b. The gross population density.
    c. The inclusion of major public facilities such as an active treatment hospital, a junior college, stadium facilities, regional park, research center and the like.
7. Letter to civic departments and outside agencies asking for their servicing and facility policies and guidelines.

Hence, by April 1970, a group of civic planners including Dave McCullagh, soon to be leader of the Mill Woods Project Team, had spent more than four months assembling and analyzing information pertinent to the SEDA project. Much of the analysis was done with the aim of better understanding the nature of the Mill Woods "problem", so that an appropriate fit between problem and solution could be found. In terms of discussion in Chapter 6, the analysis served an overarching role for subsequent generation activity; the planners deemed it to be a necessary precursor to serious solution development by a consultant group.

The April date is artificial in another sense as well, underscoring a point made in Chapter 4 about the relationship between individual problem-solving episodes and the ongoing professional history of the planners involved. According to McCullagh, the project team was able to proceed rapidly with a tentative plan for SEDA by capitalizing on the day-to-day learning and information gathering that occur as a normal part of their professional practice:

> We didn't come into the project cold. We all had a strong background in various aspects of planning.

> Frank was an American with expertise in economics. Jap was very sensitive to environmental quality concerns. He had lots of experience with European new towns. So did Alex. We had kept up with what was in the literature - Columbia, Milton Keynes, Don Mills and stuff like that. We condensed the information and applied it here... And don't forget the other intangible. Mill Woods was an exciting, unique thing for the team. It was a once in a lifetime thing. Because of that, the stimulation - the motivation - was high... Time was almost irrelevant (Personal communication, Dave McCullagh, 21 June 1989).

Mill Woods therefore provided a point of focus for the general information that planners had garnered through their training and professional practice. In terms of the search processes described in Chapter 3, it represented an opportunity for them to utilize information acquired through both undirected and conditioned search activity. In the former, exposure to relevant information occurs when the viewer has no specific purpose in mind for the information he sees, with the possible exception of exploration. In the latter, the viewer, though not actively searching with respect to a given problem, is exposed to clearly identified areas or kinds of information and is ready to assess their significance in general terms. When bringing the information from either process to bear in a specific problem-solving exercise, the individual does so by searching his internal memory stores. Such search is on a cognitive plane. With respect to Mill Woods, this means that planners pooled what they already knew from the course of ordinary professional development and assessed that information in terms of the case at hand.

At the same time, perhaps sensing deficiencies in their information pool or particular points that required elaboration, in

April 1970 they conducted a concentrated search of the external memory system, as it was called in Chapter 3. City of Edmonton files contain reference to or information about a number of new town development schemes that were identified and investigated by the project team: Columbia, Maryland; Reston, Virginia; Tapiola, Finland; Vallingby, Sweden; Cumbernauld, Scotland; Milton Keynes, England; Erin Mills, Don Mills and Kanata, Ontario; and Lake Bonavista, Calgary (Appendix II). In addition, personal handwritten notes from McCullagh's files reveal some searching of the literature with respect to the general theory and philosophy behind new town development and residential planning standards. Information was sought specifically about architectural design control, a point of particular concern during the plan preparation process. To this end, McCullagh contacted the architects and planners involved with some of the major new town schemes, including those directing the Don Mills development in Ontario:

> I am writing to you with regard to our understanding that your firm places design and development controls on all house builders participating in the Don Mills subdivision. As we are also interested in promoting a high level of urban quality, serious consideration is currently being given to this subject by members of staff... Two issues which are giving us some difficulty are the degree of control which should be exercised on single-family homes and the basis for evaluation of a submitted proposal (Correspondence from D.A. McCullagh to C.W. Cunningham, Don Mills Development Ltd., 21 June 1970).

One of the planners on the project team also visited Columbia, an American new community with the same hierarchical structure as Mill Woods, whose founder, James Rouse, is quoted on the inside cover of the *Mill Woods Development Concept Report*. Yet, overall, the search process was far from being systematic. My own survey of the planning literature to 1970 uncovered a number of new town schemes not mentioned in the files, although they were clearly addressed in the media of the day. Some of these alternatives, such as Runcorn, England, Shenandoah, Georgia, and Audubon, New York, represented a conscious rejection of the neighborhood unit, the hierarchical organization of residential structure and the form of road layout adopted by the Mill Woods planners. These schemes, innovative in their time, were by-products of the substantial body of literature that questioned the social theory underlying the more traditional new town approach. At the very least they would have served as food for thought to the project team, stimulating a reassessment of their basic assumptions about good city form. They might even have served as alternative philosophies around which optional layouts could have been advanced. Yet it is not clear that planners devoted much effort in considering and evaluating the various new town schemes they did uncover. Vallingby, Milton Keynes and Cumbernauld, all mentioned in documentary files, represent significant contrasts to the pattern established for Mill Woods. The philosophy underlying the latter two, in particular, opposes the neighborhood-community residential structure on which the Mill Woods outline plan was based. But nowhere in the files or in the 1970 seminar tapes are we given reason to believe that planners gave serious consideration to these schemes or the alternative philosophies embodied in them.

In fact, the planners were unswervingly devoted to the hierarchical arrangement of residential space, even in the face of severe criticism from the consultant group they hired to advise them on social and physical planning issues relevant to Mill Woods. One of the consultants, John Farina, expressed these reservations in strong terms:

> Dave, I should tell you in honesty that I have a personal conviction that the concept of community as it has presently been interpreted here and the kind of connotations that are being hung on it are significantly outdated... I revolt at the idea of geographic communities. The relevant concept is community of interest - professional associations, business associates, relatives, squash partners, friends - and these communities have exploded out of neighborhood boundaries... We must crack this whole idea of neighborhoods centered on schools, or kids... I've completely abandoned the idea of geographic community. You're propping up an outdated notion (Seminar tapes, July 1970).

The planners did not counter this opinion with well-reasoned arguments in defense of hierarchical ordering, based on the neighborhood. Rather, they emphasized their own need to consider the form for Mill Woods in terms of practical realities: "We as a team have to accept at face value all of the standards civic departments and social service agencies give us, whether or not we personally agree". Or, again, "We don't have the luxury of failure... Changes have to evolve gradually rather than dramatically" (Seminar tapes, July 1970). Not coincidentally, the hierarchical scheme presented by the team dovetailed neatly with the servicing standards of most civic departments and other social service agencies.

Practical realities meant that planners viewed existing off-the-shelf models with a jaundiced eye. While, on the surface, they "were anxious to pursue golden opportunity" and "the ultimate in urban form", they were really motivated by "bread and butter, pragmatic" concerns. There was no incentive to bring alternative forms such as Milton Keynes or Runcorn or Audubon forward as formal options, adapted for the Mill Woods site, because they were never considered viable for the Edmonton scene. Despite being given wide-ranging discretion by the Commission Board to "shoot for the ideal", and to place "administrative concerns second" so that "where civic standards now seem inappropriate they should not deter the development of the planning concept" (Minutes of Meeting between Dr. Peter Bargen and Mill Woods Project Team, 1 October 1970), planners were ever-conscious of the need to uphold tried and true conventions and not to force conflict within the civic administration. Such conflict would have meant time delays, and time delays would have meant unhappy politicians:

> Don't forget this. It was a matter of we have to get going on this because as soon as you acquire the land you're supposed to have the lots available next week. The perception in the politician's mind is that this is a Now Project. So what do we do? Do we go to school boards and say look, we don't like the old, tried and true system of basing neighborhoods on the elementary school? That's passe, it doesn't work? Here is a much better system. Not quite as good for you but great for us. And a year later you're still having that fight with the school board who have to approve every neighborhood plan. And you suddenly realize you've stripped a year off the time line because you've gone through this exercise of different approaches to community development. So you just don't afford yourself that luxury (Personal communication, May 1991).

In the recollection of the interview respondents, civic departments and agencies did not embrace new ideas. One planner spoke of "the great resistance to change in any bureaucratic system", and the "lack of tolerance in departments like engineering and parks". Another spoke of the "difficulty in getting all of the departments and groups to think in like terms", of them "being stuck in their own points of view" and of "counter-productive parochialism" in the civic administration. Specifically, this planner remembered an unwillingness on the part of school boards and social service agencies to entertain "broader concepts of neighborhood and community". The 1970 seminar tapes bear this memory out, as planners apprised the visiting consultants of some of the difficulties they felt had prevented a different approach from the one they had chosen:

> We can sure go down a lot of garden paths but I have reservations about it. The school system is a real good example. New approaches, no matter how valid, will be hung up at every step. They'll say, 'We're awfully sorry but the funding is provincial and the School Act says such and such and so you have to do it our way'.

In the words of one consultant, planners had allowed other civic departments and agencies to be "architects of the plan" in the interest of ensuring cooperation and commitment. To this end, notions of "best" or "ultimate" form took a back seat to gaining rapid, solid endorsement from all of the parties involved - endorsement that would be critical to successful implementation. The project team felt they had no time to lobby for concessions or wheedle for different servicing standards. The Commission Board told planners that they did not have to consult departments, "asking what they want", but the planners sensed folly in such an approach:

> What we've tried to do, and most importantly, is tell them [other departments] this is your plan, a plan for you. Not our plan. Whatever comes out of this is yours to do with as best you can... Let's not kid

> yourselves, one sewer engineer can delay this project two years if he so chooses... We as planners know that life is full of agonizing compromises... but if we couldn't have said this area would be marketed in late 1971 it might have affected the original decision to even proceed (Phil Ellwood, Seminar tapes, July 1970).

Time delay would have translated into failure by the project team, and hence the civic administration, to meet its land supply commitments. As McCullagh perceived it, the Mill Woods Project Team did not have the freedom to fail. The role of search activity and its output was interpreted in these terms.

The overriding concern with supply and marketing issues and the concomitant time deadlines affected design activity even more than search. Planners were highly conscious of having to temper their desire to innovate, to create exciting new form, with the need to be practical:

> In terms of selling, we knew in our hearts that we had to be practical and that if we were going to innovate in a radical way, we would have to be subtle... I would have to say that for whatever reason, I think we evolved to what we felt comfortable with, what we thought we could sell (Personal communications, Dave McCullagh, May 1989).

And what planners felt comfortable with was determined in large part with reference to the perceived political climate:

> We definitely knew that both levels of government were looking at this project as a land assembly which had as its primary purpose the subdivision and sale of single-family housing to bring down the cost of housing to the consumer. The basic mandate and purpose was never to create a brand new urban community which was to be totally different. Nobody ever said, we're not happy with what the norm is, take us into the realm of 'go where no man has gone before', or that kind of thing. That was never conveyed to us or assumed by us to be a realistic or practical route to follow (Personal communications, July 1989).

Planners were carrying the reputation of the civic administration on their shoulders and, according to one, "the stakes were high". "We didn't want to embarrass the people we worked for". Yet another remarked, "Day to day decisions were made with principal emphasis on marketing concerns... Brakes were put on us by people who just wanted it developed fast. Don't get too radical and don't go overboard was the message". Another seminar participant pointed out that planners had to be ever-conscious of expensive precedents they might be setting:

> The only thing that bothers me about providing a higher level of amenity than usual is the impact of it in broader terms. If we start dumping a lot of money in SEDA what will other areas say? They'll start jumping on the bandwagon saying how about throwing some coins our way. Can the City afford to do something spectacular here if it means having to do the same everywhere else (F. Grief, Seminar tapes, July 1970)?

In a sense, then, planners did not have the ultimate freedom that they thought sole civic ownership and control would bring them. Rather, they had a constraining set of marketing and political obligations which made significant changes in the norm, or status quo, practically impossible.

This need to comply with "bread and butter" marketing issues and political expectations, though acknowledged by all of the team members, did not sit equally well with them. One planner suggested that the decision to stifle innovation came from Ellwood, despite opposing views from team members who did not feel it was necessarily in the interest of good urban form. In fact, a majority of the interviewees mentioned conflict within the planning group about the direction the outline plan process should take:

> There were two major camps on the team. One wanted to slow down, worry more about design and quality. The other knew that the plan had to be implemented. They took a very practical approach.
>
> Phil's primary goal was to get land serviced and development moving. To him, planning standards were of secondary importance... Phil was very careful you didn't get anything too far out... The team wanted more quality control, design standards. When you have a team that works like this, I guess you have a lot of strong opinions.
>
> I think one of the difficulties that came over time was the hopes and aspirations of the urban design philosophy that some of us had as opposed to the pragmatic, bread and butter type of perspectives that some of the people had who were interested more in the production and sale of lots.
> (Personal communications, May-July 1989)

Comments from the 1970 seminar tapes further illuminate the nature of the conflict. In the two extracts that follow, members of the project team were debating the issue of innovation and the number of safeguards planners needed to build in to the plan to ensure that its intent was captured during implementation. In the first extract, Ellwood is responding to a comment by one of the consultants, Norman Pressman, that Mill Woods "is an opportunity to do something completely different if you want to do it... rather than doing something completely the same":

> You know, these expressions of different and innovative and experimental leave me stone cold, absolutely stone cold. Because I don't know what you mean... I think we've got to remember the scale we are at, the outline plan stage. We are creating a framework of opportunity... I get very concerned when I hear about the sameness or dissimilarity or innovation because at the outline plan stage you cannot innovate... I don't think that radicalism is a part of an outline plan. And besides, you still have the very basic question of

> whether more of the same is good or bad (Seminar tapes, July 1970).

Later, in the same session, after Ellwood had left, one of the planners suggested to the consultant group that the rest of the team did not share his view:

> Quite frankly, Phil and ourselves have very different ideas about where this thing should be going. Our basic approaches to planning are different... In terms of innovation and the other things, I look at the plan as being all-embracing and all-inclusive, that you have to try and identify everything you can at the outline plan before you commit. Phil has given me a different attitude. He wants everything open-ended because he says they'll do it all at implementation stage. But I don't know that will really happen... Phil offered to stay out of the design decisions but it makes it difficult for us to raise any issues. The Team is not team because of his lack of participation. He's operating from higher levels. He has very strong opinions because he dreamt up this project. He is in a pat position (Seminar tapes, July 1970).

In fact, far from being in a "pat" position, Ellwood played the most difficult role of all, balancing political concerns, marketing decisions and issues of sound planning practice in terms of what was, inarguably, the overriding aim of the SEDA project: to ameliorate the perceived housing and lot supply crisis. Ellwood readily acknowledges that he made decisions with a principal emphasis on "practicality" - "what would work and get us going to meet the municipal objective which is to supply serviced lots for housing" (Personal communication, May 1991). That was his ascribed role in the process. He fulfilled it, and he makes no apologies for it. At the same time, he did support planners on certain key issues, like limiting the number of large, subsidized housing projects and the need to establish a positive image for the new community at the earliest stage. His appreciation of these causes is evident in his introductory remarks to the seminar sessions in July 1970:

> One very important point that must be stressed.. SEDA must not become a 5,000 acre public housing project... It must be treated as a typical growth area, with a full range of housing accommodation, commercial activities and all of the rest. It is nobody's poor relation... In setting a plan we must be careful not to condemn the site to that image of a 5,000 acre public housing slum... We must engender good planning.

He expressed similar sentiments in a memorandum to Commissioner D.B. Menzies (29 December 1970), where he cautioned against the inclusion of public housing in the first stages of the Mill Woods development: "As I have previously indicated to you, I disagree fundamentally with the idea of opening the Mill Woods project with public housing development". From a marketing standpoint, he suggested that "there could hardly be a worse stratagem". He also emphasized that it did not make sense from a planning perspective: "To place public housing in the first stage is to place people of low mobility in the area before the community facilities including parks, schools, shops, etc. have been developed - the Mill Woods area is not immediately adjacent to any other existing residential area upon which the first stage can be dependent for community facilities." In fact, it seems that Ellwood saw marketing issues and planning concerns as related; good planning was necessary to make Mill Woods salable. As for innovation, he suggested that city residents, themselves, were not in favor of it:

> In Edmonton, the greatest restriction on innovation or experimentation has always been community reaction to it. I speak battered and bruised on the topic... We

> need to be very cautious here (Phil Ellwood, Seminar tapes, July 1970).

In this perception, marketing and planning concerns did jibe. Good planning responds to its public, which in this case, according to Ellwood, was not interested in buying into a risky venture. Thus, in deriving an outline plan, it seemed reasonable to look first to tried and true forms for possible solutions. Seen in this light, it is not surprising that the Mill Woods development concept bears strong relation to conventional new community approaches of the day.

At the same time, planners did attempt design with respect to three facets of the Mill Woods project which seemingly invited customized response:[17]

1. Location of SEDA in relation to the rest of the city
2. Government directives and political expectations with respect to low cost housing
3. Civic control over the implementation process

In each case, the design response came in the form of adaptation rather than primary creativity; and in each case, the innovation was manifested in particular elements of physical form embodied within the Development Concept Report and its subsequent implementation.

In presenting these instances of design, one of the fundamental assertions of the thesis must be reemphasized - the actual distinction between design and search, in practical terms, is far from clear cut. In many cases, it is a close judgment call whether sufficient modification of prototype has occurred to justify the term "creative response". As observed in Chapter 6, in disciplines like planning, where concepts and principles must be applied to specific site conditions, it is particularly difficult to estimate the dividing line between "existing" and "new" ideas.

An example from the *Mill Woods Development Concept Report* illustrates the fuzzy nature of the boundary between design and search. It was explained earlier in this chapter that the residential hierarchy adopted by Mill Woods planners is found in many other new community plans. What may be innovative, perhaps, is the particular representation of the hierarchy in the concept report - a sequence of diagrams that explicitly ties all of the key facets of the community together (Figure 14). It might be argued that this enhanced the original concept in some way, by making more concrete the intention of creating a socially and physically integrated whole. Whether it represents an adaptation or an innovation, though, is a matter of subjective assessment. What is more clearly an instance of design is the use of the circulation hierarchy to reinforce the social purpose of the residential structure. This aspect is considered below as one of the three facets that the interviewees identified as a conscious target for customized response during plan generation.

With respect to the first facet, the planning team recognized that the location of the Mill Woods site was problematic. From the City's standpoint, Mill Woods was not to be a separate or self-sufficient city. It was thought of as just another suburban extension, although several factors operated against that view. First, its sheer size gave it distinctive presence. With an intended population of 120,000 it was large enough to rank as Alberta's third largest urban area, behind only Edmonton and Calgary. Second, it was separated from Edmonton's other residential areas by broad tracts of industrial land on its northern and western margins (Figure 10):

> There is the real potential for a psychological barrier between SEDA and the rest of the city, with that great industrial zone there, sort of like the Rocky Mountains. Your freeways pass through the mountains and link SEDA up but psychologically there is still the blast of mountains there, or in this case, the industrial area... Why do you see people viewing it [Mill Woods] as a desirable thing?.. You've got some problems to overcome (John Farina, Seminar tapes, July 1970).

Planners were concerned that future residents would feel isolated and that the site would be seen as inferior to other developing suburbs (Figure 11). In response, they decided that Mill Woods "should have a high degree of identity as an area" without diminishing the strong role of the city's central core: "We feel strongly as a team that a population of this size has to relate to the site as a single community, bearing in mind it is not large enough to be completely self-contained" (Dave McCullagh, Seminar tapes, July 1970). To this end, planners designed the complex, hierarchical road network, which was intended to focus Mill Woods inward on itself (Figure 15). The neighborhood/community structure was emphasized through the eight inter-neighborhood circle roads, each of which tied sets of neighborhoods together into communities. Then, an inter-community loop - the secondary road system - was designed to link the eight residential communities as a unified whole. The notion of a road hierarchy was not new in itself, of course, but the number of levels was, and so was the secondary circle route. There is no evidence of this particular hierarchical system in any of the many new town studies that I examined. At Runcorn, planners did institute a loop route (actually, a figure 8) to promote public transit, but the layout of the loop in relation to other roadways discouraged inter-district travel within the town site (Bull, 1967). In the early 1960s, Cullen and Mathews described "Alcan", a hypothetical circuit linear town where all development was distributed along a single major roadway "like beads along a necklace". The entire central space was to be a major town park. The looped form was intended to facilitate movement and to promote social unity (Houghton-Evans, 1982). But because this plan represented an explicit rejection of the hierarchical roadway system and the neighborhood structure embodied in Mill Woods, it is unlikely, even given the similar objectives for the "loop" or circle route in facilitating both inter-community travel and community cohesion, that the project team looked to it as an example. In fact, there is no evidence the Mill Woods planners were aware of the Alcan model, which was not widely addressed in the literature of the time. Mike Welykochy suggested, instead, that this particular element of the outline plan was the product of the project team's own creative faculties:

> Mill Woods Road [i.e. the secondary system] is unique. So are the other circle roads. The tight linkages between all of the communities in Mill Woods, you don't find anywhere else. They talked about the same ideas in Columbia and Erin Mills but they didn't succeed on the ground. We did it through the road network to ensure strong ties (Mike Welykochy, June 1989).

The secondary system was designed to promote inter-community links. And the inter-neighborhood loops, which could just as easily have been, say, tear-drop shaped or "C" shaped for transit purposes (tying directly into arterial routes rather than the secondary system) became complete circles, also with the aim of enhancing social cohesion. By adopting a highly structured circular roadway system, and by adding another level to the traditional three-tiered road hierarchy of most new towns, Mill Woods planners attempted to respond to the perceived need to focus Mill Woods inward on itself. The road system is thus an example of design through adaptive response. The particular way in which planners tied the residential and circulation hierarchies together with the aim of promoting social cohesion rates as an innovatory feature of the outline plan.

Planners also felt a need to address the isolation problem by providing strong linkages between the SEDA site and the downtown core. Part of the solution was, of course, a natural outgrowth of the site's fortuitous location in line with the proposed Mill Creek freeway (Figure 10). But another part of the solution, which emphasized a strong public transit system incorporating future rail transit service, was more a matter of conscious design on the part of the project team. Although not innovatory by international standards, given the emphasis on public transit systems in many European new town schemes, such as Vallingby, Runcorn, Hook and Milton Keynes, this element of the concept report marked a significant change by Edmonton and North American standards. The plan called for a special transit corridor, along a major east-west arterial route adjacent to the town center site, which would provide express and rapid transit linkages to points outside the site. It was expected that at some time in the future, express buses would travel along the secondary road system (i.e. the inter-community loop), feeding directly into the special transit corridor. What is perhaps worthy of consideration as design, then, is the manner in which planners were able to capitalize on the secondary roadway system for a purpose other than social cohesion. They were not supported by Edmonton Transit officials of the day, but they believed strongly enough in the idea to leave it as a major element in the circulation system of the plan.

The second element that sparked design response from the project team was the government directive and general political expectation that the main purpose of the Mill Woods project was to reverse spiraling housing prices by providing low-cost land on which public and private housing of good quality could be built. As explained at the time by Mayor Dent, the City's objective was to ensure that houses were made available "to more and more people at a more reasonable cost", so that single-family home ownership would be "once again an attainable dream for the average citizen" (Transcript, "Your City's Business", Radio CFRN, 27 September 1970). It was also recognized that there was pressure to include considerable public and subsidized housing projects, beyond the 5 percent minimum specified in the provincial agreement (Minutes of meeting, Mill Woods Project Team, 10 July 1970). This was also to be accomplished while ensuring that SEDA retained the image of an average suburban community, albeit one of the upmost quality (Seminar tapes, July 1970). Given the overwhelming emphasis on lowering housing prices to more affordable levels, however, planners were uncertain how to ensure a positive image for the SEDA site. They were gravely concerned that Mill Woods would be perceived by the public as a low-income or "slum" area:

> This area could end up a middle class or less area. No way I see people spending $50,000 to $60,000 for a house in this area if he's got equal chance somewhere else. There is this issue of snob appeal... If this area becomes a lower-income area and you get a homogeneous group of all the same character - $14,000 to $17,000 houses - you've created a ghetto of nine square miles. How do we avoid this? Can we avoid this? Are we fooling ourselves? (Seminar tapes, July 1970)

Another planner, expressing the sentiment that would ultimately win out in the outline plan in terms of population, dwelling and tenure mix, offered a different perspective:

> I don't agree this area has to be low income or low cost. It can be very much mixed and I think there is just as much political pressure to make it so, the average, the norm, the standard. The mix will just take a lot of effort and time to achieve... Not everybody puts all of their discretionary income into house price. Some people who buy a $25,000 house might be able to afford better but they choose to spend their discretionary income elsewhere, like travel. And, you know what you're missing is that people will come to SEDA to get more for their $25,000 or $50,000 or whatever, than they can get anywhere else... I have some problem with this type of discussion because it seems to me you automatically have established in your mind certain narrow categories of people. The focus has to be on creating an environment that people can have the best quality of life in (Seminar tapes, July 1970).

That the concept report called for a wide range of dwelling, tenure and population types was not particularly innovatory. So, too, did a number of other new town schemes, including Erin Mills and Columbia. But what was unusual for the time was the particular way in which heterogeneity was to be achieved, not at the town or community level but within each neighborhood unit. In Welykochy's words, there was to be "a range of housing right from a quarter-of-a-million dollar homes to little 25 foot lots, all mixed together right next door, without changing neighborhoods. There is no transition line and that was a conscious part of the design process. It's unique." Though the outline plan delineated specific density zones, with the highest density sites clustered around the town center, then a medium-density linear core and low-density communities beyond that, planners intended a mix of social, economic and cultural groups within each unit of 5,000 persons. This much is evident from discussion at the 1970 seminar sessions, and also from the implementation process, which ensured that the mix described by Welykochy did in fact occur. And, although the suggestion of neighborhood heterogeneity was not new in theoretical terms (Mumford, 1954), it did fly in the face of the norm in new town development which stressed the desirability of homogeneity - at the block level certainly and perhaps even at the neighborhood level to promote social cohesion and prevent conflict amongst neighbors (Gans, 1961; 1967; Keller, 1968; Lansing, Marans and Zehner, 1970). Even in Columbia, where heterogeneity was an expressly stated principle of the design plan, and for which it was called a radical departure from traditional approaches, the mix was conceived on a town-wide level, not within individual neighborhoods and villages (Bull, 1967). At Mill Woods, however, that was clearly the planners' intention, and it marks a significant adaptive response on their part to their perceived context. It was not expressly spelled out in the concept report, but that was probably a function of the close working relationship that was expected to develop between the project team and an implementation group assigned the task of turning the plan into reality. At the 1970 seminar sessions, the planning team members were reminded of the unique opportunity they had been afforded:

> We will be doing this as a City. We can rest assured it [Mill Woods] will turn out like we want it to. There are no private developers to give us trouble, to subvert the plan (Phil Ellwood, July 1970).

It was the freedom inherent in this promise, to be able to ensure high quality development through civic ownership and control, that served as the impetus for the third design response by the project team:

> Freezing of a concept and flexibility are things we very much have control over. And this relates very much to our role in the preparation of the plan... We will be involved, carrying the thing right through to the door knob... Let's not forget the difference between this and other outline plan areas. In other cases, once you've published the outline plan, it is frozen. You can't make changes because developers jump in and make decisions based on that plan... In SEDA we don't have that problem. Without the developer pounding at us, saying, 'Damn it, you've changed your mind and I've invested millions of dollars on the basis of what you said you would do because you published a plan', we have the capability to react to what we learn as time goes on (Phil Ellwood, July 1970).

By virtue of the City's role as developer, Ellwood was suggesting, planners could leave some decisions open and still be sure that the general intentions of the plan would be respected during implementation. With this reassurance, the *Mill Woods Development Concept Report* emphasized flexibility as a key aim in the overall philosophy of the outline plan:

> To effectively plan Mill Woods where the City of Edmonton is a major land owner and developer the 'open-

> ended' planning process has been adopted as being the most appropriate technique. This method views the developing community as a complex interaction of diverse and functionally dependent parts - parts evolving over time as they themselves adjust to an ever changing context around them (Edmonton, 1971, unpaged).

To facilitate effective response to unknown change, the concept report advanced a "broad frame" within which "considerable flexibility can occur allowing adequate opportunity to innovate with new physical forms, development control, building techniques and social service systems" (Edmonton, 1971, unpaged). Again, however, as with population mix, the simple inclusion of a statement supporting adaptive ability did not, in itself, rate as design. Flexibility was a catchword of the day for new town planning, serving as a major theme in the Milton Keynes plan and rating mention by planners of Columbia, Erin Mills, Cumbernauld, Runcorn and Hook. What is innovative in the Mill Woods approach, certainly by Edmonton standards, was the manner in which planners implemented the flexibility policy. Once again, their intentions were made clear at the outline planning stage. Confident in their control over the development process, they did not designate the future land uses of the communities of Southwood, Ridgewood and Burnwood (Figure 13). They called these blocks "agricultural reserve". The concept came about in response to views expressed by consultants at the seminar sessions:

> One of the other concerns we have, too often in planning there is a locking in of the initial concept, a lack of flexibility and capacity to adjust to social change as development progresses. We're interested in seeing the inclusion of specific areas as completely undesignated, reserved. This builds in a potential for flexibility as development progresses... Use land between neighborhoods or housing groups - large

> blocks, regularly shaped parcels with good transportation facilities... (Seminar tapes, John Farina, July 1970).

In these terms, flexibility meant not committing everything all at once. It fit within the general sentiment that civic ownership and control afforded a unique opportunity for planning and implementation to be woven together.

7.5 Conclusions

As a preface to relating the Mill Woods case study back to theory in Chapter 8, it is necessary here to underscore the nature of the practical task the Mill Woods planners faced. On the surface, the Mill Woods project seemed to be the perfect embodiment of all of the conditions touted in new town theory as providing the optimum opportunity for planners to ensure the development of top-quality urban form. Mill Woods was to be a large residential community, crafted on a greenfields site, and unfettered by the constraints of prior development and fragmented land ownership and subdivision. Its form was to be derived with the utmost attention to advanced planning and urban design techniques and comprehensive site development. All of this was made possible by the City of Edmonton's sole ownership of the site, and the control it was able to exercise through all phases of its planning and development. In reality, though, the expressed intentions were more posture than commitment on the part of a civic body enmeshed in political circumstances and obligations that placed the economic aim of the land banking exercise above all other considerations. City council was publicly and legally committed to the rapid and efficient development of land in Mill Woods with the ultimate goal of providing low-cost and affordable housing and reducing house prices generally throughout Edmonton. This commitment, above all else, shaped the nature of generation activity and the nature of the form selected for the outline plan. It set the framework within which the Mill Woods Project Team interpreted the proper mix of search and design and the number of alternatives generated. Ultimately, the need to make land available, quickly and cheaply, translated into a number of situational conditions which profoundly affected the generation of alternatives stage:

1. It created severe time constraints for the preparation of the outline plan.
2. It served as a catalytic focus for conflicting viewpoints within the planning team.
3. It set the tone for inter-departmental communication and negotiations.

Mill Woods planners felt largely constrained by their obligations to a public body that theory suggested would permit them great latitude in devising a showpiece of new urban development. In the final analysis, political accountability proved as hard a taskmaster as the profit motive of many private new ventures, such as Columbia or Erin Mills.

With respect to generation activity, planners conducted search and design as overlapping processes, though the role of design was restricted to those aspects of the planning problem that planners thought required customized response. It also took the form of adaptation rather than primary innovation. There was no attempt to freewheel, to explore new possibilities for the sake of exploration in the hope that some solution would emerge that would better an already existing form. Planners were driven not by the aim of creating a variety of solution possibilities but with the aim of devising a single, adequate and politically safe response. Innovation risked time delays and time delays risked political goodwill. Planners would have had to wait for creative inspiration to strike and it might not have struck very quickly. Even if it had struck, planners would have faced the task of selling innovative new concepts to what they perceived was a stodgy, convention-bound group of civic departments and agencies. Time delays would then have been a veritable certainty for a planning team already concerned about their ability to meet development target dates. In addition, innovation was viewed as a risk for the successful marketing of the Mill Woods venture. As Ellwood so aptly pointed out, the City was not participating in the project with the expectation of losing money. Tried and true formulas for new community form, despite shortcomings recognized at least in part by the team, thereby acquired an edge over design response.

Search activity was similarly constrained. As a result, planners did not conduct an exhaustive investigation of the external memory, nor did they attempt to fit each of the options they found in their search to the particular Mill Woods site. Rather, on the basis of incomplete search, limited to several new town models gaining the most attention in the literature and those already known to members of the Project Team, planners tentatively chose one solution for full development and evaluation. It was an amalgam of elements from a few prototypic examples, though there is no evidence to suggest that the process by which they chose these elements was either systematic or well-reasoned. Rather, the seminar tapes from July 1970 pinpoint many instances where planners seemed unable to offer sound rationales for their selections. Similarly, they were willing to accept the consultants' recommendation that undesignated parcels be adopted as a policy for Mill Woods without questioning the basis for that recommendation or determining if, in fact, it had been successfully tried elsewhere. There seems to have been an implicit presumption that they could select a new alternative for development if their chosen one proved unsatisfactory at some later date or was rejected at a political level, but that was foolhardy, given the time constraints they were working under. Yet this was almost the situation they were faced with when the outline plan was voted upon by City Council and endorsed by a narrow margin. In sum, search was a rather haphazard process, conducted over a ground prepared by experience, a knowledge of theory and principles, and an analysis of site and purpose. Planners made their choices quickly - maybe impulsively - driven by the need to meet the overriding development objectives.

This is not to say, however, that planners made their selections unwisely - such judgment is not the purpose of this analysis. Moreover, it would fly in the face of apparent evidence that a large segment of Edmonton's population finds Mill Woods an acceptable place to live. The City has never had trouble selling its lots there (save for the period of economic recession in the early 1980s, which affected housing demand in the city as a whole), and is presently five years ahead of schedule in terms of marketing projections (Edmonton, 1989). This would seem to suggest that planners succeeded in creating a desirable community. The question remains, however, might planners have done a *better* job if they had been allowed more rigorous search and design opportunities or if their evaluation had been more systematically and explicitly carried out? For instance, might they have selected another circulation system for Mill Woods instead of the one so often criticized for its confusing layout if they had fully generated another option or developed a series of models for the Mill Woods site? Speculation, perhaps, yet a valid avenue of questioning. What it boils down to is a question of whether the constraints or practical difficulties themselves precluded different generation practice and a different choice of form, or whether it was a narrow view of those constraints that dictated the nature of the generation stage. Given a different perspective on the part of management it is entirely possible that a different overall approach to plan generation would have emerged. Or different strategies by the same team - say an active campaign for the chance to present even two fully developed options to Council - might have altered the trend of the process. In view of the conflict on council regarding the concept form for Mill Woods (evident in the close vote to adopt and subsequent squabbling reported in the media over the plan), this latter suggestion may have been more of an option than planners judged it at the time. In any event, planners took a reading of a politically difficult context and responded to it. This shaped the nature of generation activity and the type of form selected for the Mill Woods site.

In one critical sense, however, the planners' decision to devise a single scheme for Mill Woods must be seen apart from the local context, resting instead on their overall view of the need for alternative generation in planning. In the interviews conducted with planners in 1989-1991, there is a strong undercurrent of belief that planners have some special knowledge or ability that enables them to "know" the best form, without having to develop a series of full-blown options. In view of the fact that four of the participants now believe the circulation system to be confusing and one feels that the town center was wrongly placed, it is worth questioning the surety of that knowledge and ability. Here we are back to issues of theoretical development - educating and equipping planners with a better understanding of their role in a public and democratic planning system and of the importance of alternative generation in general. Perhaps the demanding political circumstances of the Mill Woods project did preclude any more systematic or rigorous generation practice or any other choice of form. Then again, perhaps not.

NOTES

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1. Some theoretical concepts demonstrate that it is possible to organize a grid network as a hierarchy (Houghton-Evans, 1982). In practice, however, the rectilinear grid system is not associated with hierarchical organization. It should also be emphasized that the initial, and still powerful, impetus to curvilinear forms was aesthetic - the Romantic aesthetic.

2. The subdivisions predated the use of site design and land use planning standards.

3. Of the 2,630 hectare site, 2,265 hectares lay outside the city boundaries, on land that the Edmonton District Planning Commission had designated as agricultural. The other 365 hectares were zoned for industrial expansion (Edmonton, 1971, unpaged).

4. METS did propose another freeway - the South Freeway - as a more direct link between the southwestern suburban sites and downtown. According to Phil Ellwood, this route was never seriously considered by civic officials, because its construction would have "cut a devastating swath" through well-established and viable southside neighborhoods. At the time of Mill Woods, the Mill Creek Freeway was the only element in METS that had received formal aproval by Council. Subsequently, it, too, was discarded as a viable transportation option. The Mill Creek Freeway has not been built and never will be.

5. At the time of Mill Woods, Edmonton was governed by a council-commission form of government in which city council delegated executive and administrative powers to the commission board, comprised of senior administrators and the mayor. Under this system, administrative proposals went before the commission board before they ever reached city council (Masson, 1985).

6. Section 127 of Alberta's Municipal Government Act requires that if a municipality wishes to purchase land in another municipality, that municipality must be notified in advance.

7. Ellwood offers an interesting interpretation of the provincial government's interest. He suggests that its waning popularity, evidenced in city by-elections, made it keen to regain favor with Edmonton voters. He recalls that provincial officials approached Mayor Dent inquiring what the government could do to assist the City. Mayor Dent suggested the SEDA land acquisition as a possibility. Official documents record the government as having initiated the landbanking idea (Bettison, Kenward and Taylor, 1975), but both Phil Ellwood and Clive Rodgers remember the SEDA acquisition as occurring at the behest of the City.

8. Memorandum of Agreement between the City of Edmonton and the Alberta Housing Corporation, 29 June 1970.

9. The emphasis here is only on those facets of the agreement with direct consequence for the area's physical development. The reader is referred to Le Bourgeois (1981) and the original memorandum of agreement for discussion of financial details of the landbank.

10. There may have been another agreement signed by both parties, but it is no longer on file. My impression that there was a formal agreement about the start of development comes from discussion with Ellwood and from documentary records. In a November 1969 document, entitled "The South East Development Area", Ellwood stated that "every effort will be made to meet this deadline", meaning the fall of 1971. Then, at a 2 December 1970 meeting of the Coordinating Committee on Mill Woods, comprised of senior officials from participating city departments, Mr. Menzies (Commissioner) advised that he "had written to Mr. Orysiuk, Executive Director of Alberta Housing, specifically asking that occupancy in Mill Woods be deferred until July 1, 1972".

11. The Mill Woods Development Concept Report was presented to City Council and received as information on 27 April 1971. Preliminary drafts of the document were available 4 December 1970, for internal review by the Superintendent of Planning. No major substantive changes occurred after this time.

12. Revised population targets, based on a rezoning of many multiple family sites to single-family dwelling lots, place the eventual population closer to 100,000.

13. Terminology within the concept report is not wholly consistent. In some instances the term "community" is used to denote the whole of Mill Woods. In others, it refers to a specific level of the residential structure formed by the combination of 3 or 4 neighborhood units. In the seven development objectives in the thesis text, community is used to refer to Mill Woods at large.

14. In 1961, the Joint Planning Committee prepared a report for City Council examining school and park requirements in the area known as the "Douglas District". Even though the standards outlined in the report were not intended as general rules for other districts, they became a guide in all future subdivisions.

15. Frost (1985) provides a full discussion of Edmonton Transit policy for residential areas.

16. Central Mortgage and Housing Corporation added the further safeguard that no building was to be within fifty feet of a right-of-way boundary, rather than from the pipelines themselves.

17. What is purposely left aside here is the obvious point that the SEDA project, as a whole, was an innovation by North American standards - and certainly in terms of anything attempted by Edmonton's civic administration. The circumstances that resulted in this innovatory response were detailed earlier in the chapter.

Furthermore, it lies outside the direct purview of the plan preparation process.

CHAPTER 8

THEORY REVISITED

8.0 Introduction

This thesis has been premised on the belief that the value of urban planning to society must be measured by its ability to contribute to sound choices about the desired future form for an urban area. Within the decision-making process, planners might rely on other participants to set goals, establish criteria for evaluation or make choices among alternatives, but it is their responsibility to explore and identify the range of land use options available to the decision makers. In fact, it is their presumed expertise in these matters that grants them legitimacy within the policy-making process. Because planning has become synonymous with the exercise of responsible choice - meaning the acquisition of an adequate base of information and understanding to make choice a deliberate and meaningful task - planners are obligated to develop the skill and knowledge necessary to facilitate this task. With respect to the generation of alternatives, this means they must possess a thorough understanding of the nature of generation activity, and its relationship with other aspects of the planning process and with the conditions of planning practice.

The principal purpose of the thesis has been to contribute to this understanding by providing a relevant description and interpretation of generation activity in theoretical and practical terms. The theoretical task was accomplished by utilizing a substantial body of literature, largely from outside the planning field, to identify the essential characteristics of design and search, their relationship to each other and those aspects of their characters most problematic from an urban planning perspective. The practical task relied on a case study of Mill Woods to identify the difficulties planners might face in carrying out a theoretically-sound generation task. Overall, the thesis represents an attempt to provide a germane interpretation of generation activity for planning purposes. For too long, the planning profession has relied on a rather mixed bag of generation methods - some intuitive and some quantitatively rigorous - without any real effort to understand the nature of the activity they are meant to serve. Yet it is only by examining the inherent nature of policy and plan generation, the many different kinds of thought and knowledge involved, that planners can ever hope to develop the kinds of methods and procedures that will truly meet their intended purpose. The thesis marks a beginning step in such an examination.

This chapter provides a brief summary of the theoretical basis of the plan generation and the results of the Mill Woods case study. It does so with the broader aim of fulfilling the third objective of the thesis research:

> To interpret the significance for plan generation theory of the practical limitations revealed by the Mill Woods case study.

The principal aim of the objective is to determine whether refinements in the theoretical framework established in Chapters 3, 4, 5 and 6 might be necessary to respond to the practicalities identified in Chapter 7. Recommendations for further study are also advanced.

8.1 Search and Design: An Integrative Perspective

Within the generation of alternatives stage of the planning process, search and design must be seen as parallel, overlapping processes (Figure 2). Each has its own very different role within the larger process of plan and policy generation and each has its own methods, procedures, skills and abilities which are seen as important to effective solution attempts. At the same time, search and design are linked by their shared purpose to the planning process - to provide a range of well-spaced decision options. This purpose arises from the planner's commitment to the concept of rational choice made against a solid backdrop of information and understanding and the definition of his proper role in a public and democratic planning process.

In addition, design and search are linked by a number of other factors related to the nature of planning problems and the nature of the cognitive processes that underpin the quest to achieve the best possible fit between problem and solution. The core of any generation activity, be it search or design, must be to understand the demands of the problem for any solution form - its unique features as well as the points of similarity it shares with known problem and solution frames. In order to achieve this understanding, the planner must treat search and design as complementary procedures, with an overarching analytic activity serving as a basis for both. In Schon's (1987; 1988) terms, the planner frames and reframes the problem, interpreting the problem "as" one he is familiar with while actively pursuing those areas within the current setting that resist his attempts to impose his existing knowledge base. He treats the generation episode as a global experiment in which he tests and re-tests the limits of his own understanding in terms of the fit he is able to achieve. Acquiring this fit between problem and solution might mean simply lifting existing forms from the shelf, it might mean shifting and adjusting the forms he knows, or it might mean embarking on a process of complete innovation. Existing knowledge is central to all three processes. In the first instance, through search, it serves as the sum total of generation output, while in the second and third instances it serves as a catalytic agent - a springboard - for design. Where the planner adapts an existing solution form or forms, the resulting solution, though somehow innovatory or new, is clearly linked to the old one. At this point, the division between design and search is noticeably blurred. Where the planner derives complete innovation, via the processes of primary creativity, the break between the existing and the new is easier to discern. In fact, it is rather the link with the old, the relationship of the new form to existing knowledge, that is harder to ascertain. Yet clearly, innovation always occurs against a background of knowledge which somehow prepares the ground for the new response. The designer might not engage in physical search but he does have at his disposal, within his cognitive stores, the array of knowledge and experience that aids in the new interpretation of the problem.

The overall point is that search and design must be seen as parallel processes which overlap for the reasons discussed above. They are parallel by virtue of the demands of a rational, urban planning framework which is anchored on a belief in responsible and informed choice. Central to that belief is a commitment to betterment, to actively pursuing new policy-making alternatives or physical forms in the chance that they might offer a better fit with problem conditions than the solutions already at hand. Design should not be seen as a contingent activity, triggered only by failure to identify existing alternatives. Instead, and of course tempered by the practical circumstances that constitute the bounds of any real-world problem-solving exercise, design and search must be seen as integral partners - both essential to the larger process that constitutes the generation of alternatives stage.

That design is often treated as a subsidiary of search relates, no doubt, to its difficult nature. It is a multifaceted blend of analytic, synthetic and evaluative activities that the designer relates and structures differently according to a variety of contextual and personal factors. The success of the process cannot be predicted in advance. Because it occurs primarily on a cognitive level, where it eludes direct observation and conscious control, design is a part of the "irrational realm" where the planner must simply wait for results to appear. He can attempt to force them, by performing a variety of methods, like brainstorming and synectics, but there is no guarantee that the creative flash will strike. In fact, in some instances, luck and fortuitous circumstance seem to stand on equal footing with consciously-contrived procedures in provoking ground-breaking discovery to occur. It is here that design is problematic from a practical planning standpoint. There is no infallibly correct process or sequence of operations that will guarantee effective solution response. Design does not operate according to the timelines and deadlines of a typical planning agency. Moreover, the skills and abilities involved in constructing creative response, at least in the sense of primary innovation, seem relatively rare - the purview of a rather select few. At the same time, there is substantial evidence that attempts to understand the design process and to develop ways of nurturing and teaching its practice offer some prospect for improving the likelihood of design response. As researchers unravel at least part of the mysterious process, examining the way designers read and interpret key elements in setting and context, how they reason their way from problem to solution and how they make the balanced and integrated judgments essential to design response, they gain some control over the slippery task; not total control but at least enough understanding for ground to be gained. Eckersley's (1990) results with improving design response through the conscious insertion of heuristics into the design process is particularly noteworthy. Through such study comes a greater awareness of the purpose of systematic and quantitative design methods to the designer - not as substitutes for the intensely subjective interpretive judgments that are required, but as tools or aids in processing information rapidly and efficiently, in structuring ideas and in facilitating understanding of the consequences of particular decisions and actions. Here it must be emphasized, though, that the promise for design in such research does not mean that people without the requisite capacity to be dramatically creative can be taught to be Einsteins or Mozarts. Still there is reason to believe that conscious attempts to improve thinking skills and the thought process can benefit everyone to some degree. That is, the designer's ability to perform is strongly affected by knowledge, experience and practice. Equally as important though, it is also affected by motivation. Planners must be convinced of the purpose of innovation for planning, of the need for bettering and improving what exists if commitment to design is to flourish on a practical level.

Within the broader desirability of innovation lies a much smaller area where design is absolutely essential because existing solutions are clearly inadequate to the needs of the problem. Here, the intractability of design poses a special problem for the rationality of decision. If creative response is not forthcoming, the planner is in a tight spot in terms of his ability to solve the problem at all, never mind worrying about a best solution form. True, by playing semantic games with the interpretation of rationality, by defining it in terms of the practical limitations of the situation, we can come to conclude that the planner's presentation of an insufficient range of alternatives and the decision-maker's subsequent choice of a somehow inadequate solution still adhere to rational principles. The decision was the best one in terms of the information available at the time, under those specific, situational conditions. But the problem remains:

the practically rational solution is still not an effective one and there is no way around this dilemma. The planner might forestall decision, hoping for improved solution development in the future, or he might make his decision with ultimate attention to the need to preserve flexibility to change course in the future if innovation should occur. There is simply no neat answer to the limits of design on effective decision-making in this regard. Luckily, the absolute need for primary creativity is relatively small. For the most part, planners can pursue design with the aim of betterment rather than as an absolute necessity for planning response.

In most instances, then, planners can rely on the identification of existing solutions and their adaptation to meet their problem-solving needs. In this blend of search and adaptation lies increased hope for meshing the generation task with the demands of rationality and effective decision-making. Certainly, planners conducting search face critical problems of information storage and retrieval, but given consistent effort on the part of the planning profession to improve reporting forms and procedures, these problems are not insurmountable. To make effective use of an existing prototype, planners require sufficient detail to be able to judge its relevance to a known problem. They require information about the prototype's context of origin and its performance there, the problems it was intended to solve and the goals and values implicit in its adoption. Since attention is now being devoted to the development of information and storage systems, particularly computerized ones and those focusing on graphic or visual display, there is hope for improvement (Salton and McGill, 1983; Schachter, 1983; Batty, 1987; Bracken and Webster, 1990). Equally important, though, planners must be convinced of the need for rigorous search that goes beyond a casual, haphazard scanning of a few known sources. As with design, their motivation toward comprehensive and deliberate alternative development is essential if practice is to improve. Planners will devote themselves to arduous generation activity only if they understand its inherent value to effective decision making. Instilling such understanding is the purview of planning process theory.

8.2 Mill Woods: Integrating Theory and Practice

8.2.1 Summary of the Practical Difficulties

The influence of politics on the planning process has been long recognized within the discipline - in particular on the setting of goals and objectives, the choice among alternatives and even the implementation of plans. The Mill Woods case study makes it clear that such influence extends to the generation of alternatives stage as well. At the outset of the plan preparation process in 1970, Mill Woods planners undertook their project assignment with much excitement and zeal. They were to play a central role in giving form to the largest public land bank in North American history and they were determined, in the words of one planner, "to show private industry how to do it right". After all, new town theory touted large-scale suburban sites, under sole public ownership and control, as providing the optimum conditions for deriving high-quality residential environments. At the same time, right from the start, planners were beset by a number of political and other situational constraints which made plain the real extent of the opportunity that was afforded to them. Above all else, Mill Woods was seen by politicians and senior officials within the civic administration as the answer to Edmonton's perceived housing crisis. It was to permit the rapid introduction of a large number of relatively cheap lots onto the residential market with the ultimate aim of reducing land prices throughout the city. Although the *Mill Woods Development Concept Report* listed a second major goal for the project - the creation of a high-quality residential environment - this was of subsidiary concern to political decision makers. Planners were free to pursue high-quality residential design and innovation only insofar as they did not interfere with the principal economic objectives of the project.

In practical terms, the emphasis on the land banking objective translated into severe time pressures on the Mill Woods Project Team to produce an outline plan very quickly. Provincial and civic politicians expected construction shovels to hit the ground by the fall of 1971. This necessitated planning the first neighborhood, normally a step that would follow the outline plan stage, concurrent with the planning of the entire site. In terms of generation activity, it meant a decision on the basis of practicality to develop only one fully-developed solution. In addition, it meant relying largely on what was available in ready-made models. There was no time to sit idle, waiting for the creative muse to visit, and certainly no time to invest in convincing civic departments and agencies to veer from their traditional approaches to service delivery. As a matter of what they perceived to be practical necessity, planners eschewed those aspects of plan generation which, in theoretical terms, might have improved their likelihood of providing a showpiece of new urban development. For the most part, planners treated innovation as a last resort, actively pursuing new form only where it was seen as essential to meet the peculiar needs of the Mill Woods site. Primary creativity was never really attempted at all.

This commitment to quick and ready solution, by means of search rather than design, was reinforced by a civic administration that seemed largely predisposed to convention rather than innovation. As the discussion in Chapter 7 demonstrated, the senior management official charged with supervising the project team vigorously discouraged design for design sake. Instead, driven by his larger role in the Mill Woods scheme, which was to see land serviced and developed quickly and cheaply, he focused on pragmatic concerns such as servicing details and deadlines and marketing issues. Nor did innovation receive any more sympathetic response from the array of civic departments and agencies that were critical for plan approval and for implementation success. From the point of view of Ughanwa (1988), cited in Chapter 4, the Mill Woods project lacked important ingredients for an effective design process. There was no favorable attitude toward innovation on the part of management and no willingness to commit whatever resources were necessary to ensure the best possible urban form. And though compartmentalization within the project team was not a factor, parochialism within the overall civic administration was. The Mill Woods planners' voice for innovation and design quality was diluted to a whisper within the larger civic body. Particular elements such as architectural control, co-location of education and social service agencies on multi-service sites, the inclusion of "parkettes" within housing groupings and the extensive use of water as an aesthetic feature were abandoned by the team in favor of what they perceived was a more politically-safe concept form. As a result, planners did not deem the outline plan to be ideal from an urban design standpoint. It was, instead, what planners felt all of the actors in the Mill Woods process could live with.

8.2.2 Relating the Mill Woods Case Study to Theory

It would be foolhardy to modify theoretical statements, be they normative or descriptive, on the basis of a single case study. Rather, Mill Woods must be seen as one frame in the continuous process of self-reflection and learning that any forward-thinking discipline engages in. It contributes to a finer-grained understanding of the practical circumstances that planning theory must address if it is to properly equip practicing professionals.

As a beginning step in achieving such understanding and in utilizing the Mill Woods case study to illuminate theory, it is necessary to determine points of match and mismatch between the theoretical expectations laid down in Chapters 3 to 6 and the practical development of the Mill Woods plan preparation process. The generation process for Mill Woods exhibited at least some of the characteristics ascribed to search and design in earlier chapters of the thesis. First, planners did engage in an overarching phase of analytic activity which fueled both search and design processes. Though they appeared, at first glance, to have derived a conjectured solution form on the basis of a few cues from the environment, very early in the generation process, their conjecture was, in fact, based on substantial analysis of site and setting undertaken in the four months prior to the official delegation of the project to the planning department. Moreover, according to team leader Dave McCullagh, the diverse and varied backgrounds of the individual team members meant they each could contribute substantial information, knowledge and experience acquired as a part of the ongoing stream of learning that professional life entails. The Mill Woods problem provided a point of synthesis around which such learning could gel.

In terms of the framework provided in Chapter 6, then, planners did not arbitrarily impose a conjecture on the problem to order the analytic task but rather derived their conjecture on the basis of substantial analysis and knowledge. This process of informed conjecturing then guided subsequent analytic and generation activity. However, in keeping with observations made by Akin (1986), Mann (1987) and Rowe (1987) in similar empirical studies, Mill Woods planners held firm to this conjectured form even in the face of criticism and an obvious need for further reflection. In part, at least, this stemmed from the practical time constraints they were under. Some six months into the process planners could not realistically abandon the form and begin the process anew if they wanted to maintain political goodwill. The way they chose to order the plan preparation process, focusing on one fully-developed solution, meant such a reversal would be tantamount to admitting a mistake. At the same time, it is unlikely, even in the face of criticism, that planners saw a need to secure alternative conceptions of the site. It seems obvious that analysis sequential to the initial conjecture was done more with the aim of refining the solution than with ensuring its overall fit. In Schon's (1987; 1988) terms, the Mill Woods planners were not fully open to the "surprises" they encountered, nor were they ready to reshape their understanding of the problem in response to feedback they received. Information that did not fit with their one frame of the problem was largely ignored. Whether this approach was wholly the result of political and time pressures is impossible to ascertain after the fact, although the comments of two of the planners, expressing a belief in the inherent capability of planners to intuit the best response to a problem, suggests other factors played a role. Perhaps - and just perhaps - planners did not engage in more explicit alternative development or more rigorous analysis because they perceived their informal evaluative approach to be adequate, certainly to the needs of a project geared toward economic concerns and maybe to the needs of planning in general.

In terms of problem-specific difficulties that might have dictated their approach, what is of concern is whether or not planners were adequately prepared to face these difficulties. Might other approaches or skills have better served the aim of effective decision-making by permitting them to develop a range of alternatives whilst not disturbing time deadlines? Planners for

Milton Keynes developed and evaluated five alternatives within a six-month time frame, and after four months of site analysis, the team for Columbia was able to produce a large number of sketch plan alternatives over a six-month period. If Mill Woods planners had been better equipped to deal with the politics of the situation might they have been able to sell a different approach to their political leaders? Might a different mix of skill, ability and personality have provided different results? The questions are certainly worth pondering given evidence in Chapter 1 that conscious attention to alternative development does enhance the probability of solution effectiveness. What is of equal concern, though, for theoretical development, is whether or not planners were adequately committed to the concept of alternative development. Given the dearth of attention to alternative generation in the literature, perhaps planners in general are not convinced of the need for alternatives from either a rational or a socio-political perspective. It is here that theoretical development must begin, with an emphasis on the proper role of planners within the decision-making process and the need for alternatives seen in this light.

In terms of search, the Mill Woods planners encountered many of the informational difficulties highlighted in Chapter 3. Few of the discussions of new town prototypes in the literature revealed much about context or goals and objectives. And few, partly as a matter of the timing of the Mill Woods project, were able to provide detailed information about the effectiveness of their approach; sufficient time had not passed for such judgments to be made. Planners went with the most common approach of the time: a hierarchy of residential spaces and a hierarchy of roads. The latter was adopted in spite of widespread criticism that was beginning to surface in the literature of the day and, as is the case with many of the plan's key elements, it is not clear that planners had a rationale for the choice that they made. Rusak's (1968) study of Vallingby, Sweden observed the same lack of justification for decisions made there about the physical form for that celebrated new town.

As far as the circulation hierarchy was concerned, the choice was made seemingly on the basis of what appeared to be the best advice of the time, though in the twenty years since Mill Woods there has been much critical comment about curvilinear streets and hierarchical roadway design. Langdon (1988), for example, speaks derogatorily of the circulation systems typical of planned new towns from the Mill Woods era. They have roads, he says, that "meander so capriciously that they sow confusion... it can be almost impossible to find an address in a suburban planned unit development if you have the misfortune to be invited there at night". Similarly, Duany and Plater-Zybeck (Langdon, 1988; Anderson, 1991) challenge the circulation orthodoxy of "dead-end suburban cul-de-sacs leading to 'collector roads' that in turn funnel all traffic to the highway, every driver jammed on to the same crowded road". In vogue instead, in the 1990s, is a comprehensible grid system of narrow roads, intimate scale and convenient shopping. But alas, the planners of Mill Woods were not privy to such new-found wisdom. And in terms of the most prevalent options available in the literature of the day, their choice of form for the community was not out of step with the time. Their search process did fail to uncover the limited number of decidedly different forms in evidence in the 1960s but given the general tenor of their analysis, discussed above, it seems safe to conclude that planners would not have chosen differently even in the face of these alternative conceptions. Planners were not, in the main, predisposed to alter the status quo.

Once again, the planners' attitude seems as much a result of their approach to the problem as of inherent constraints. This much is suggested from the project team's approach to design. Planners suggested that they were not free to pursue innovation because Phil Ellwood actively discouraged them from doing so. Yet, at the same time, they readily acknowledged that he largely stayed out of the physical plan generation process. He did not second guess their creation of the secondary road network, although it is obvious from planning documents of the day that the route did not have the unequivocal endorsement of either transportation engineers or transit planners. Nor did he quibble about circle routes within communities or chunks of land to be left undesignated. In fact, when I questioned him about the rationale for any of the physical form decisions made for Mill Woods, he deferred to the expertise of the planners on the project team. What he did control more directly was the planners' incorporation of economic and land banking stipulations and their adherence to a strict time line. If innovation meant deviation from these aims, it was clearly expendable. For a team of planners wholly inexperienced in terms of primary creativity and with limited experience in large-scale residential planning, this translated into a restraint on design. Given a different blend of experience, education, cognitive style and personality, perhaps different or more numerous alternatives would have been possible within the same time frame. In forming the project team, the planning department supposedly offered up the best personnel it had available. But maybe in terms of varied and comprehensive alternative development, to the end of deriving and selling the ultimate urban form, its best was not sufficient. Through no fault of their own, team members may not have had the requisite capacity to meet design tasks. They could adapt existing forms - this much is evident from their accomplishments - but could they create largely new forms? Perhaps city council is at fault for taking the politically safe route and assigning the job to personnel within civic ranks. As one of the Mill Woods planners remarked, a design competition might have opened up interesting possibilities.

In terms of the framework advanced in earlier chapters, it seems likely that the personal characteristics of the planning team played a significant role in shaping the nature of generation activity. What if the team leader had been less easy going and less committed to compromise within the civic administration? What if he had challenged the Commission Board to stand firm on its word, to take a role in ensuring that civic agencies fell in line with the wishes of the planning team rather than the other way around? There are documented instances where strong personality and political skills have gone a long way in altering the course of a decision-making process (Caro, 1974; Gerecke, 1975; Kaplan, 1982). What if the team had had a Le Corbusier or even a Llewelyn-Davies? Even within the political, economic and time constraints, other generation strategies might have been advanced. From a theoretical perspective, then, the Mill Woods case study seems to argue for more specialist skills within generation activity. Planners with vision, planners with analytic and evaluative capability, planners with form-sense and planners with political acumen all have a role to play in guiding the generation of alternatives stage. The relationship between the political/administrative context and the shape of generation activity is not wholly deterministic then. Even given the difficult set of practical circumstances that they faced, Mill Woods planners must accept some responsibility for choosing the course that they followed.

At the same time, given the concerns about the general thrust of their generation activity it must be re-emphasized that the rather pell-mell search and design decisions that were made by the Mill Woods Project Team did produce an *acceptable* residential community - upwards of 80,000 people have so far chosen it as a place to live. From a theoretical perspective, though, the issue is whether or not the form *could* have been better and whether or not more rigor in generating alternatives would have induced that better form. Some of the criticism of the Mill Woods project - for its maze of roadways, its pattern of service provision, the large number of multifamily sites and the intra-neighborhood mix of population - pertains directly to decisions made within the generation process. These decisions, as discussion has shown, resulted from the application of less analytic and evaluative rigor than the framework in Chapter 6 deems wise. The thesis argues for a systematization of the generation of alternatives stage of the planning process - not that the design process be rigidly encased within a step-wise formula or that search be carried out mechanistically, but that the entire generation process be the product of thoroughness and rigor, of sensitive, integrated and well-balanced judgment. The fundamental aim of such activity must be to improve the overall process of choice. In Mill Woods, this theoretical aim and practical purpose did not mesh.

Utilizing the case study to illuminate theory, this failure to mesh appears to relate, in part, to an inadequate emphasis in the theoretical chapters of the thesis, on organizational and political circumstances as constraining forces on generation activity. Chapters 3 to 5 concentrated on generic descriptions of design and search, drawing information from disciplines whose practice centers mainly in the private rather than the public domain. There is no reason for these disciplines to incorporate an interpretation of political feasibility into their generation practice. Chapter 6 emphasized the significance of the political nature of planning in providing normative direction to the overall form of generation activity - that it provide a range of alternatives representing all of the interests in society and that the process be open to public debate and scrutiny. Political and organizational factors were not ignored in the interpretive assessment but were subsumed under a general concern for "sufficient" analysis of wicked planning problems.

The Mill Woods case study seems to support a more explicit and separate treatment of these factors than that. Certainly they were the most significant ones in determining the nature and scope of generation activity within that planning process. As noted above, planners did engage in overarching analytic activity prior to embarking on search and design, but this analysis passed through what could be termed a *feasibility filter* that served immediately to constrain the nature and degree of search and design undertaken so as to conform with city council and senior management expectations. This practice stands in marked contrast to planning process theory which tends to introduce estimates of political feasibility *after* alternatives are generated (Seni, 1978; Chapin and Kaiser, 1985; Alexander, 1986). Seni includes this type of analysis in "second-order evaluation" and suggests it is most appropriately situated between the generation of alternatives and their technical evaluation, prior to decision. The Mill Woods case study places such evaluation earlier in the planning process, serving as a focusing step within the generation stage itself.

As asserted in section 8.2.1, it would be foolhardy to modify theoretical statements on the basis of a single case study, particularly in light of sound justification for situating second-order evaluation subsequent to generation activity. The capricious nature of political expectations makes generation activity focused narrowly on political feasibility, politically naive. A shift in political will necessitates a complete reorientation of the generation process, meaning that valuable time and organizational resources are wasted. A case study examining regional planning within the Edmonton metropolitan region made this point most dramatically when planners suffered vitriolic condemnation from their political masters when political circumstances shifted, leaving planners unprepared to offer relevant policy options and therefore seeming to support a growth management policy that was unpopular (Bayne, 1986). Similarly, in the years since the Mill Woods concept plan, when aldermen have questioned certain planning principles, such as the high proportion of subsidized and multifamily housing units, planners, were they asked, could not muster an argument in defense of their choice. They could not justify the plan as having been the best form possible because they did not seriously consider any other forms.

By injecting political feasibility as a dominant concern in generation activity, planners appear to lose their ability to inform the decision-making process in the manner outlined as being desirable in Chapter 2 by widening the range of choice open to their client group. What is apparent from the case study, at the very least, is a need to reassess the role of second-order evaluation within the planning process. It is not possible to conclude, on the basis of the thesis research, whether theory or practice must be realigned to better meet the needs of sound planning. It is possible to conclude, however, that there is a critical need for further study in this regard.

8.3 Implications For Further Study

In a thesis such as this one, where the fundamental aim has been to respond to inadequacies in existing planning process theory, it follows naturally that almost every facet of generation activity that has been discussed merits further study. The thesis marks only a beginning step toward a definitive statement of generation activity within a rational planning framework. At the same time, particular aspects of plan generation do stand out as areas of pressing concern for planning methodologists. First and foremost, attention must be given directly to the question of second-order evaluation, discussed above. In addition, what stands out as a principal concern is whether or not practicing planners are committed to the concept of alternative development. Such investigation is a necessary precursor to development of effective methods and skill, since in the absence of a willingness to derive options, no method or skill will serve its intended purpose.

In addition, as a forerunner to the development of skills and methods, research efforts must shed more light on the nature of the naming and framing process that planners undertake. This is what Schon (1987) and Porter (1988) have done for architecture. More must be learned about how *the planner* reasons his way from problem to solution. The emphasis in such research must be on understanding the basis upon which the planner makes interpretive judgments - what influences his choices and what motivates his actions. Does his commitment to responsible choice made in the public interest make his approach to problem solving any different than, say, an architect or product engineer? Such research will relate discussion of design and search even more directly to the unique substantive needs inherent in an urban planning framework.

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APPENDIX I

MEMBERS OF THE MILL WOODS PROJECT TEAM

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APPENDIX II[1]

NEW COMMUNITIES

EUROPEAN

Cumbernauld, Scotland (1958)   1,680 hectares   70,000 pop.

The Cumbernauld plan explicitly rejected the use of neighborhood units on the grounds that they diminished civic pride by encouraging residents to look inward to neighborhood centers rather than outward to the town as a whole. Cumbernauld is a dense town designed around a linear center with vertically segregated vehicular routes and pedestrian areas. Adjoining the center are the highest density residential areas. Density decreases toward the periphery where built-up area terminates in an open space surround of open areas for recreation use. Of the total population, more than 70 percent are accommodated within a 15 minute walk of the central spine. There are no open space bands between residential areas and no neighborhood centers. Residential areas are served by loops and cul-de-sacs off the central spine road and an outer ring road, and a complete system of footpaths: "The idea is to have residential areas linked on one side to a main road, giving access for vehicles, and on the other to a pedestrian way leading to the centre" (Osborn and Whittick, 1969, p.49). Primary schools and other community facilities are strung out along the pedestrian pathways. Most shopping facilities are situated along the central spine although local convenience stores are provided within residential cells. Although service areas for elementary schools were given names, they were not intended to function as neighborhoods. Nonetheless, Whittick (1967) labels this aspect of the plan a distinction without a difference, noting that local residents have developed neighborhood ties to the catchment areas despite the planners' insistence that there are no neighborhoods. The plan's most innovative features according to Godschalk (1967) are its compact linear center and its sophisticated transportation planning system (Godschalk, 1967; Whittick, 1967; Willmott, 1971).

Harlow, England (1947) 2,590 hectares 60,000 pop.

Harlow was the first British new town to utilize a hierarchical ordering of residential areas. In Harlow, four housing groups of about 1,000 people each comprise a single organizational unit. Each one focuses inward onto a sub-shopping center, an elementary school and a playground area. Two to four of these are clustered around a major center of twenty to thirty shops, a hall, health center, other services and a sports field. Four such neighborhoods, separated from each other by broad wedges of green are organized around the town center. Two main industrial areas are located on the periphery and four smaller industrial areas (i.e. service industries) are located adjacent to major community centers. The overall density of residential areas is high, at 20 persons per hectare. The circumferential pattern with major arterials extending outward from the town center and concealed within broad open space bands separating the four cluster neighborhoods (Britain, 1947; Godschalk, 1967; Nott 1968; Gibberd, 1970).

Milton Keynes, England (1970)   8,865 hectares   250,000 pop.

Designed by Llewelyn-Davies, Milton Keynes is premised on the belief that systems of inward-looking communities (i.e. neighborhood units) do not relate to people's real needs in terms of education, shopping or social facilities. The plan depicts a low density, spacious development (3.2 dwellings be hectare) with ample open space. Its most distinctive features in terms of new community design are the use of an orthogonal grid layout of roads in approximately one kilometer squares and the rejection of neighborhood centers in favor of "activity centers" located at points of crossing for major transportation routes and pedestrian roadways. Primary schools are located at activity centers and secondary schools are dispersed throughout the town along major arterial routes. Hence, residential areas do not look inward on neighborhood centers or an elementary school but, rather, outward to major transportation roads. Although a town center exists, where some administrative, culture and recreation facilities and a major shopping center are located, the plan explicitly advocates the dispersal of many major facility sites and major employment centers throughout the town. According to Llewelyn-Davies, Milton Keynes is designed to permit easy movement and access between all points in town and to permit maximum flexibility of choice for residents in terms of services and facilities.

A significant aspect of the project is the planning process which was undertaken. The planning team initially spent three months in a series of seminars and discussions defining goals for the design exercise. Planners then devised five alternative urban forms, fitted to a variety of transportation networks, and evaluated them against the goals they had initially established. Alternative generation was a conscious and deliberate aspect of the planning exercise (Llewelyn-Davies, 1966; Whittick, 1969; McGovern, 1970).

Runcorn, England (1964) 2,930 hectares 90,000 pop.

In Runcorn, the principle of neighborhood planning was followed such that residential communities of about 8,000, each containing shopping centers, schools, clinics and social facilities are strung together along a public transportation spine which forms the figure 8. The town center occurs at the crossing. Automobile traffic is channeled along an outer ring road with a cross-link to the center of town and collector roads into residential areas. By and large, because the majority of residences are located within 0.4 kilometers of the transit line, the dominant mode of transportation in the plan is public. Generous open space is provided in the areas enclosed by the loops (Bull, 1967; Godschalk, 1967; Osborn and Whittick, 1969).

Stevenage, England (1949) 2,470 hectares 60,000 pop.

The basis for the Stevenage plan, the first new town in Britain, is the neighborhood unit. In comparison with Perry's original formulation, though, the size of each neighborhood has been doubled. Six neighborhood units of about 10,000 people each are grouped around a town center, in a semicircle. Each neighborhood has two or three shopping centers in centralized locations. Elementary schools are similarly placed. Secondary schools with larger catchment areas are sited on the edges of the neighborhood units, with their playing fields used to define the boundaries between them. The plan designates a large industrial estate, closely related to the town center site, though separated from it by a railway line. According to Gibberd (1970), the Stevenage plan is particularly noteworthy for its clear and uncluttered road layout (Vincent, 1960; Willmott, 1962; Bunker, 1967; Gibberd, 1970).

Tapiola, Finland (1952) 270 hectares 17,000 pop.

Of all of the new towns and communities, Tapiola is thought by many to be "the most beautiful and the most humane" (Strong, 1971). The plan expressed, as a conscious aim, the fostering of a harmonious relationship between urban man and the natural environment. In structure, the physical form consists of a town center and three main neighborhoods (5,000 - 6,000 people each), separated by green belts and linked by roads and footpaths. Overall density of the site is 12 persons per hectare, with 56 percent of the site designated as open space. This large open space allotment was accomplished by using many three and four story apartment complexes. Each neighborhood contains a central service area consisting of primary school, kindergarten, youth center and grocery store. Arterial roads connect the neighborhoods and the town center while neighborhood roads are designed as loops or dead end streets. The entire road system is curved and branching. An extensive pedestrian walkway system blankets the town. According to Godschalk (1967), the site is blessed with a beautiful natural setting which combined with the Finnish "mystic reverence for nature", dominates the layout of the plan (Godschalk, 1967; Strong, 1971).

Vallingby, Sweden (1951)   910 hectares   65,000 pop.

Vallingby lies within the Stockholm region where the regional transportation plan designates the public transportation network as the single most important consideration in the distribution and location of new urban growth. To this end, "the Vallingby group" is a series of six districts, each having 10,000 - 15,000 people, and strung out like beads along a mass transit line. The centers of each district are the transit stops along the public transit route. Collocated with these stops are commercial and cultural centers. The central of the six districts contains a larger array of services and shops and performs a traditional "town center" role. Within each district, housing is located within walking distance of services and the subway line. All apartment complexes are located within 455 meters of a district center. Automobile traffic is restricted in large measure to the periphery of residential districts. Each district is separated from the others by wedges of permanent open space which "link together to form fingers of green" (Popenoe, 1977, p.37). Planned in the linear tradition of Soria Y Mata, the Vallingby plan is noted worldwide for its imaginative integration of open space and high density dwellings. Fully 95 percent of Vallingby residents are housed in multifamily dwellings and apartments although the overall density of the site remains fairly low (10 persons per hectare). At the same time, Rusak (1968) suggests that Vallingby residents are largely dissatisfied with housing and open space provision (Godschalk, 1967; Rusak, 1968; Pass, 1973; Popenoe, 1977).

AMERICAN

Audubon, New York (1970-71) 810 hectares 25,000 pop.

Audubon was planned and developed by the state of New York within the boundaries of Amherst, an existing town. Following the example of Milton Keynes, the transportation system is dominated by a large scale grid of main roads (roughly 1 1/2 to 2 1/2 kilometers apart). Facilities such as convenience shops, schools, medical and day-care centers are located along major transportation routes. The collocation of compatible service groups within the same facility is promoted. The community is planned to look outward to the Amherst community as a whole, rather than inward to the center of the site. Most importantly, at the scale of each residential area there is a mix of housing type, tenure, style and layout. Twenty percent of housing is designated low-income and ten percent assigned for elderly accommodation. Six local centers are proposed, with along major thoroughfares. (Turner, 1974).

Columbia, Maryland (1963) 5,545 hectares 110,000 pop.

Columbia has received more critical acclaim than any other new town venture, save perhaps Tapiola, or Vallingby. In addition, although the core of its physical design, the residential hierarchy, was used many times before, Columbia is considered by many to be the most innovative of new towns. It is designed around the concept of overlapping community structures, of which the neighborhood is the basic planning unit. Each neighborhood is planned for 800 - 1,200 families (2,000 - 5,000 people) in a variety of housing types arranged around a neighborhood center containing an elementary school, a park, a convenience store and a multi-purpose meeting room. All facilities are within walking distance of each home. Villages, made up of between four and six neighborhoods service 10,000-15,000 people with secondary public schools, shopping facilities and recreation services existing at a location central to the village site. The town center is placed so as to service all of Columbia and an additional catchment area of perhaps 250,000 people. Though heterogeneity of population is maintained as a planning principle, the mix was intended at the town scale rather than within neighborhoods. Overall density in Columbia is fairly low. As a point of comparison, the site, double the size of Mill Woods, was intended to house 10,000 fewer persons.

One of the most distinctive aspects of Columbia is its intensive planning process. The developer, James Rouse, gathered experts from a variety of disciplines such as planning, education, health care, housing, banking, religion, recreation, day-care, real estate, marketing and architecture, to spend one year setting objectives and goals, *devising alternative plans* and evaluating sketch plan alternatives (Godschalk, 1967; Hoppenfeld, 1967; Sunderland, 1967; Breckenfeld, 1971; Rouse, 1973).

Jonathan, Minnesota (1968) 3,240 hectares 50,000 pop.

The Jonathan plan includes five villages of 7,000 residents each, with shopping areas and other facilities located in the center of each village. An additional 15,000 residents are housed at higher densities near the town center. Forty-five percent of the land is residential and eighteen percent is reserved for open space. The plan incorporates innovative housing types - "stacked-up housing" and "flexible housing modules" - with the aim of providing dwelling systems at low and middle cost. According to Bon H. Cunningham, Jonathan's director of design, the concept was planned around a system of parks, lakes and greenways. These served as "a frame" into which major elements could be placed. By late 1974, Jonathan Corporation, as one of the first new towns founded under the U.S. Housing and Urban Development Title IV guarantee, had defaulted on its interest payments (Cunningham, 1971; Burby and Weiss, 1976).

Reston, Virginia (1965) 2,995 hectares 75,000 pop.

In neighborhood unit tradition, Reston was designed with seven villages clustered around a town center site. Overall residential density was low, although three bands of density were provided within the site. High density, multiple family housing (24 persons per hectare), was clustered around the center, moving outward to medium density sites (5.5 persons per hectare) and to outlying low density zones (1.5 persons per hectare). Like Columbia, the plan stressed diversity and population balance although mix was intended at the town scale rather than on an intra-neighborhood basis. Twenty-three percent of the site was designated open space.

Shenandoah, Georgia (1971) 3,125 hectares 70,000 pop.

Shenandoah differs from most American new towns in two important senses. First, located outside the Atlanta metropolitan area it was planned to be largely self-contained rather than a dormitory suburb. Second, the majority of housing is to be town housing and two-story apartments, with only twenty-five percent of development assigned to single family dwellings. Twenty percent of the total dwelling units are assigned to "below market" or low-cost housing provision. Planned by Llewelyn-Davies (though owned and developed by Scott Hodgens), the physical form for the town rests in the Milton Keynsian tradition, with some adaptation to fit the distinctive site (Turner, 1974).

CANADIAN

Don Mills, Ontario (1952) 830 hectares 29,000 pop.

According to Sewell (1977), Canada's planned suburbs - the basic design elements and business practices now used - are directly derived from the Don Mills approach. The Don Mills plan contains five elements that were new and untried in Canada:

1. Neighborhood principle: The community is broken into four neighborhoods, surrounding a regional shopping center. In true neighborhood unit fashion, the hub of each neighborhood is the elementary school. Each neighborhood also has its own local store and church. The four neighborhoods look toward a town center for regional shopping service, a high school, a library, a post office and other high order services.

2. Vehicular/pedestrian traffic separation: Pedestrian walkways were established leading to the center of each neighborhood and to the town center site. As in Stevenage and Harlow, England, a hierarchy of streets was a part of roadway design. Two arterial roads bisected the middle of the site and this is the only bisection of streets in the plan. All others form "T" intersections. A ring road separates the town center from the residential neighborhoods.
3. Green space provision: Green space is the major design element in the plan.
4. Work opportunities: Don Mills was not intended to be a dormitory suburb of Toronto and so included an industrial park.
5. Architectural and design control: In order to ensure high standard of design, all houses required architectural review and only approved materials and colors would be used. In addition, lot sizes were wider than the standard sized lot of the time. This too, enables aesthetic design control (Pressman, 1974; Sewell, 1977).

Erin Mills, Ontario (1975) 170,000 pop.

Although the general plan was not published until 1975, land assembly began in the early 1960s and planning was under way at the time of Mill Woods (1969 - 1970). Erin Mills is comprised of four large communities, each containing 40,000-50,000 people. Each community is broken up into eight to ten neighborhoods, each one centered on an elementary school and "basic" commercial services. The town is served by a hierarchy of major and minor roads, organized on a modified grid and laid down to provide strong links within and between the four communities and town center. The town center and the four community centers are located along major transportation routes so as to maximize the efficiency, comfort and safety of daily travel. Provision of efficient public transit was an essential consideraton in the design of the street system. The plan stresses a heterogeneous mix of population, flexibility for future growth and the creation of a strong, varied and active town center (Canada, 1976; Ross, 1976).

Kanata, Ontario (1966) 1,295 hectares 70,000 pop.

Kanata is an upscale suburban community designed by Bill Terron. According to Pressman (1974), it stands out as a design "tour de force" because of its emphasis on the preservation of open space and natural landscape and the provision of amenities. The smallest component in the residential hierarchy, serving as the basic building block of the plan, is the housing cluster: each house belongs to a cluster, "with a personality of its own" (Canadian Building News, 1966). Within the cluster, great attention is paid to compatibility of houses and terrain and compatibility of people living in the cluster. Clusters come together into neighborhoods, centered on an elementary school and park site. Three neighborhoods come together into a community, based on a community center. These centers are located along a band of pedestrian walkways on a continuous park system. Each community center contains shopping facilities and "quarters for the senior citizens, for the childless couple or for those who do not wish a detached private house". It also contains major recreation facilities, a library, play school "and such other facilities as the community desires". Five communities focus around a town center containing major cultural facilities - a theatre, a library, an art gallery, a Y.M.C.A., a conservatory, civic services, a hostel and a convention center. Roads follow a hierarchical system, with particular attention given to "protection of the residential environment" (Canadian Building News, 1966; Pressman, 1974).

NOTES

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1. One of the problems with searching for existing forms is the inconsistency of information from form to form and source to source. Therefore, information is presented here in accordance with what was available in the literature. This means that for some of the communities there is precious little to say while for others, detail abounds. This information problem cannot be avoided and serves to demonstrate the very real problem practitioners face in looking for existing solutions.